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Engineering News-Record

April 28, 1921

American Engineers Study Water Supply and Sanitation in Greece

American engineers recently finished an eight months' survey of the sanitary needs of Southern Greece—more particularly of the sewer and water-supply requirements of Athens and Piraeus, whose facilities have ...ved since the era of Grecian ...minance. Walter E. Spear, who ...arty, gives in this issue the results of the study—an absorbing description of a modern civilized country whose engineering development has not kept pace with the rest of the world.

Ancient Fountain at Thebes in Greece—The Only Source of Water for a Large Community

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ENGINEERING NEWS-RECORD

DEVOTED TO CIVIL ENGINEERING AND CONTRACTING

E. J. Mehren, Editor

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A Valuable Structural Record

WHATEVER be the opinion regarding the New York State Barge Canal as an economic factor there can be no doubt of its high standing as a work of engineering. With few exceptions its structures have been models of detail design which may well be set up as standards for future shipping canal work. The state engineer, Frank M. Williams, is to be congratulated, therefore, for issuing as a part of his 1920 report a "book of plans," which includes, in large scale, drawings of the principal structures on the canal. Too infrequently are the structural records of big projects preserved in such convenient form.

Vicious Garbage Legislation

AT FREQUENT intervals an attempt is made to prohibit the disposal of the sewage or garbage of a city outside its own limits. Two vicious pieces of such legislation, which would virtually prohibit the disposal of the garbage produced in any one of the five counties comprising New York City outside of that county was rushed through the New York Legislature in its recent closing hours. To make the action worse, in order to remove the bill from a possible veto by the Mayor of New York, the bill masqueraded as an amendment to the general health laws of the state, although limited to cities with a population of a million or more. One bill prohibits the transportation of garbage from one county to another for disposal and a second prohibits the construction of a garbage disposal plant in any county without permission from the aldermen from that county. Followed to its logical end, since it splits the city into subdivisions, such legislation would limit garbage or sewage disposal to the wards in which it is produced, then to the blocks, the houses and, in the case of multi-family houses, to each apartment. When governor of New Jersey Woodrow Wilson vetoed a similar but more honest bill governing sewage works. It is to be hoped that this dishonest and otherwise vicious bill well be vetoed by the governor.

Flowability and the Minute Mix

WHETHER the word used be consistency, flowability, or workability, the condition of concrete described by the term is of great importance. Those who are studying it are trying to express by test and observation the approach to perfection of mixture that concrete attains. For the finished material this can be measured by strength, but that determination comes too late to affect the makeup of the sample or of the batches it represents. Measures of workability, on the other hand, are applicable while the concrete itself may be changed to cure any revealed defects. This workability is manifestly a function of material and mixing, though more emphasis has heretofore been put on the former than the latter. Some tests made by Prof. W. K. Hatt and recently reported to the American Concrete Institute show how large a part the mixing plays. It was found, for instance, that workability, as measured on the Bureau of Standards flow table, increases with the time of mixing, provided the quantity of water is kept constant, the change being particularly marked between 30 sec. and 1 min., and not changing much thereafter. In other words, it is possible to obtain the same workability by mixing 1 min. with a given amount of water that is obtained by mixing ½ min. with 25 per cent more water. Contractors sometimes resort to the ½-min. mix to save time and then supersaturate the batch to make it flow readily. Tests before this have shown that short-time mixing reduces strength but not before has there been quantitative observation of the relation between workability and time of mixing. This makes doubly necessary an insistence on a longer mix.

Hysteria on Immigration

THE reintroduction in Congress of the Dillingham bill which would restrict immigration to 3 per cent annually of the number of the respective races now in this country brings forth further reflections upon our hysterical handling of great national questions. It is less than a year since a strong group advocated wholesale importation of Chinese coolies. Today the voices of the members of that group are stilled by the demand for work from some millions of unemployed. There exists now little or no sentiment for letting down the immigration bars. On the other hand, there is rampant, as never before, demand for rigorous restriction of immigration. Many who now demand restriction sincerely believe that the influx of undesirable foreigners will have a serious influence upon our national life. Most of them, however, if they run "true to form" are exclusionists at present for temporary economic reasons. Labor in this country is plentiful, they say, why then admit any more? A year hence, if labor should be scarce, these same gentlemen will probably be clamoring for the admission of Chinese coolies. All of which is, for those who see it, an argument for a careful study of the racial, political and economic effects of immigration and a founding thereon of a policy that can be pursued year in and year out and that will, in the long run, be for the best interests of America.

Racial Versus Economic Reasons

OBVIOUSLY there has been a material change in the immigration situation the last generation—a change too well known to need elaboration here. In brief, the nations of Southern Europe have not the characteristics of those which contributed the bulk of immigrants 30 years ago. That fact has made the racial consideration of possibly dominant importance. No one desired formerly to restrict America as a haven for those who were politically and religiously oppressed. Such oppression

has well nigh passed, but even if it had not we would be forced to consider whether we should continue to offer a haven at the possible expense of serious deterioration of American national life. A picture is easily drawn of the detrimental influence of these Southern and Western European races, but while there have been many sociological studies we doubt whether the facts have been fully marshalled and fairly analyzed. If upon a fair study the decision should be adverse to large immigration no American would continue to advocate a policy that was plainly detrimental. However, if the conclusions on racial grounds should not be overwhelming in their finality the economic argument would have considerable weight. How much common labor must we have annually? is the form in which the economic question is usually stated. That, too, has never had an adequate answer. Now each one answers it in accordance with his own limited experience. For ourselves we believe that an answer based upon close study would be rather shocking to those who are fearful lest our industries will be seriously crippled by a shutting off of the European common-labor supply. We have great faith in the ability of American inventors to supply labor-saving machinery; and with that faith we believe that we can get along with a considerably smaller proportion of common labor than we have today.

A Near-by Trade Opportunity

AN INTIMATE story of the lack of sanitary conveniences, public utilities and other facilities enjoyed by the average American citizen is told in the notes from Barranquilla, Colombia, on p. 732. Mr. Bunker's apologies in the last paragraph are hardly called for, since if all of the things he mentions were at a standard equal to that in the States there would be less reason for engineers to be interested. River improvement, dock facilities, paving, sewers, an improved water supply, all cry for the work of the engineer. Already some engineers are on the ground, laying plans and awaiting only financial support. The opportunities are great. Although Colombia has potentialities for agricultural development equivalent in area to the heart of the Middle West plows are unknown. Already there are signs of the awakening. Barranquilla recently has experienced a growth similar to that of our Western cities—10 per cent in two years. This, however, is to be expected, for the rich back country, most of whose products must pass through this port, is beginning to make strides. Colombia also contains one of the rich oil fields of the world and the development of these fields will bring added commerce. Railroads are projected, while some motor automobile enthusiasts are proposing motor-truck highways as competitors of the railroads. When it is appreciated that Colombia is our near neighbor—only 4½ days from New Orleans—it need not be argued that we are the logical country to further its development. If American capital will seize the opportunity there will be much work there for the American engineer.

Deceptive Highway Propaganda

DISCLOSURES of unsoundness in the financing of highway projects in Arkansas throw a number of interesting sidelights on the methods which good roads "boosters" in that state and elsewhere seize upon to win public opinion to the support of large bond issues. The average taxpayer does not understand the federal-aid law. By the use of such catch-phases as "a fifty-fifty basis" for state and nation, many people are tricked into voting for bond issues in the belief that every dollar raised locally will be matched by the federal government. The fact that certain federal funds are distributed to the states is distorted into a representation that is misleading and that is resulting in the assumption of obligations in excess of what would be approved if the truth were known. The fact that the federal funds are limited has sometimes been concealed when state and local bond issues are to be voted on, as was the case in Arkansas. Alabama is another case in point. In the propaganda for a recent bond issue of $25,000,000, a circular issued by the Alabama Highway Improvement Association carried these statements: "This is a 50-50 proposition. Uncle Sam puts up $1 and requires the state to match it. If Alabama fails or refuses to put up, the money goes to other states." The plain inference here is that $25,000,000 of federal funds would be forthcoming in the event of an affirmative state vote. As a matter of fact, the total federal apportionment to Alabama from the time federal-aid began in 1916 up to the present, is only $5,776,000. Many people who supported the bond issue did so in ignorance of these facts. This type of chicanery, even though it be successful for a time in providing funds for highway construction, will, in the long run, do the cause of good roads irreparable damage.

Engineers in City Government

WITH engineers for two of its five city commissioners or councilmen and six other engineers in important city offices, Memphis, Tenn., is certainly entitled to rank as "a city that is recognizing its engineers" (p. 734).

Few cities can show even one engineer on their commission or council; not many, even among the larger ones, place engineers in administrative positions not distinctively engineering in character; and by no means all cities have engineers in charge of work that can be efficiently done by engineers only. Commission-plan cities, in particular, would profit by having at least one and better yet two engineers among their small membership. The reason for this is that in the plain commission, as contrasted with the commission-manager, cities, the commission exercises administrative as well as legislative functions, each commission heading an executive department.

Since the larger part of city expenditures (outside of education, which is rarely under a city commission) is for engineering works and services, it is good business as well as good sense and good engineering, to have engineer-commissioners in charge of departments that control engineering work. This is recognized at Memphis, where one of the engineer-commissioners is commissioner of streets and bridges and the other of fire and police. In most commission-plan cities (again as contrasted with those of the commissioner-manager form of government) the laymen commissioners are not long in office before they qualify, in their own minds and often in the public mind, as "experts" and relegate the city engineer and other technically trained men to the rear. The result is often a general muddle, with a loss of confidence and even of self respect on the part of the members of the engineering staffs.

A word of caution is needed. Engineer-members of city commissions should not fall into the pits they are sure to dig for themselves if they attempt to be

engineers of the departments they head instead of legislative and administrative heads. If they do this they will follow the erroneous paths of the laymen commissioners.

Why Chicago Does Not Filter Its Water

WITH the ring of towns on Lake Michigan around Chicago which filter their water supply getting more complete every year and the larger cities on all of the Great Lakes filtering or seriously considering it the question why Chicago does not filter its water supply is a logical one. Various answers have been proposed. One is that the removal of the sewage by the drainage canal is so complete as to make further expenditure for a clean, potable water unnecessary. Another is that Chicagoans must wait for a settlement of the controversy over the amount of water which may be diverted from Lake Michigan via the drainage canal before they can agitate the filtration question without jeopardizing their chances of a favorable consideration of their claims. Then there are suspicions that advocates of long tunnels to intakes far out in the lake are powerful enough to be able to hush up any talk about filtration.

Whatever weight these proposed explanations may have the really critical factor is that of waste. Until Chicago can at least halve its present daily consumption of 265 gal. per capita, requiring the operation at peak loads of practically all of its fifty-two pumping engines, with their 1,170 m.g.d. capacity, filtration is economically out of reach. This is the greatest obstacle confronting the official who would propose filters. Immediately he must take up the cudgel for waste prevention. Twenty years ago John Ericson, now consulting engineer to the city, started a campaign of waste reduction which has been kept up intermittently ever since. The water department knows all about this waste. A permanent engineering corps has been in charge of water waste since 1907 and a complete record is available showing use, abuse and an intelligent estimate of future requirements in every square mile of the city. Mr. Ericson's successor as city engineer, P. S. Combs, worked out a comprehensive water-works program, based on the necessity of consumption under limited metering, which would cost $60,000,000 by 1950. (See *Engineering News-Record* April 21, 1920, p. 855). The present incumbent, Alexander Murdock, has been in office too short a time to outline a policy. If he concludes to reduce waste rather than buy more equipment and extensions he will have many influences to combat. If he could hold out equivalent contracts for filter installations he might have a powerful lever with which to sway aldermanic support toward vigorous effective waste prevention. Ten million dollars will meter Chicago. Much less with intensive waste surveys will cut consumption to a point where filtration may be talked of as within reason.

But does Chicago need filtration from the sanitary standpoint? Her typhoid rate in 1920 was 1.1 per 100,000, the lowest of any of the large cities. Unmistakably the lake is polluted, the polluting matter varying from domestic sewage sweeping down from the north shore suburban districts not yet under the Sanitary District to sewage and trade wastes from the intensely industrial districts of South Chicago and Indiana towns at the southern end of the lake. Some amelioration, it is true, is to be expected. Evanston seven years ago determined to take no further chance and built filters. Winnetka is soon to ask for bids. Waukegan has long agitated filtration. Last fall, to the south, East Chicago and Whiting each put filters into service. Chlorine kills microscopic organisms and to it must be given much credit for Chicago's very low typhoid rate, but filtration must eventually be the first line of defense. Continually there are complaints of medicinal tastes and odors which the public lays to chlorine, but which may be produced by its combinations with phenol trade wastes.

Clear water, free from taste, eventually will be demanded, but no filter salesman need hasten to pack his grip for an assault upon Chicago, for the waste problem must first be solved.

Government Reorganization

WE COMMEND to the careful study of every reader of *Engineering News-Record* Mr. Hoover's views on government reorganization. He has, as usual, put the nub of the situation with unusual clarity.

"The administrative units of the government," he says, "must be regrouped so as to give each of the great departments more nearly a single purpose." And, again, in expanding his views he gives this succinct reason for what he advocates: "The real economy to the nation lies in their [the departments'] more effective functioning in their daily relation to the public. The extra cost imposed upon business in general in the determination of the relation of any particular business to the different functions of the government, with the unnecessary duplicating interferences and demands, is a real charge on national wealth, probably as great in some directions as the actual cost of the administrations themselves.

In addition to laying down broad principles of government reorganization he jams into one brief paragraph what an ordinary man would consider a lifetime program for his own department, that of Commerce. That last paragraph of his address if studied and expanded would be found to be a synthesis of all that we have been told, or in our fondest dreams imagined, that the British and the German governments have done for their trade, industry and transportation—the prompt and accurate diagnosis of economic events, economic tendencies, and economic ills; the prompt and accurate survey of economic opportunity, economic discrimination, and economic opposition; the giving of scientific advice and assistance to industry through furnishing prompt and accurate data upon production, supplies and consumption; co-operation on standardization and simplification, on the elimination of waste in industry, on economy in production and use of power, the synchronizing of industry and transportation; in fact, assistance so far as government can assist in the solution of the broad problems of trade, industry and transportation.

We had something to say in a laudatory way in our issue of March 3 regarding Mr. Hoover's entrance into the Cabinet. That was prediction of a certainty. We were relying on Mr. Hoover's past accomplishments. Now there is being presented to the Cabinet, to Congress, to the broad ranks of government officials and to the public a conception of the service that government can render commerce such as has never before been given expression in our public life.

So far all of this, however, is merely proposal. Realization depends upon the sturdy backing of Mr. Hoover's vision by business men and by the public at large.

Water Supply and Other Sanitation in Greece

Climate, Meteorology and Hydrology Outlined—Scanty Water Supplies and Lack of Sewers and Other Sanitary Facilities—The Athens Water-Suppy and Sewerage Project—Land Drainage and Malaria

By Walter E. Spear
Civil Engineer, New York City

The following notes are the outcome of a visit in Greece of nearly eight months, during the past year, as the representative of Ford, Bacon & Davis, engineers of New York City. Under a contract between this firm and a group of Greek bankers, a large staff of American and Greek engineers was employed on investigations for a complete system of water and sewerage for the cities of Athens and Piraeus and adjacent seashore villages. These investigations required that all water resources within 100 miles of the city of Athens be considered and took the writer over a large part of southern Greece.

EUROPEAN civilization first dawned in Greece and attained there, 2,400 years ago, a brilliancy never surpassed elsewhere. After centuries of decay and stagnation and long years of alien misrule, Greece has but recently recovered her independence and is slowly repairing the neglect and waste of ages. Greece is still one of the backward countries of Europe, however, poor in natural resources and as yet without very many necessary public improvements. Among other needs, Greece lacks modern sanitation. A few large urban communities have been created, a few beautiful public buildings erected, streets and parks constructed and some transportation provided but, on the whole, the problems of sanitation have been neglected. Little, indeed, has been done in a large way in Greece on the construction of water and drainage works since the early days of Imperial Rome, 1,800 years ago. The attitude of the Greek people toward some questions of water supply and sanitation presents problems quite unlike those encountered in this country and the climate and topography of Greece, the peculiar geology of the country, the profusion of troublesome and injurious insect life and the all pervading dust provide other sanitary problems that are somewhat unusual and, if viewed upon the background of ancient Greece, they cannot but be of interest to American engineers.

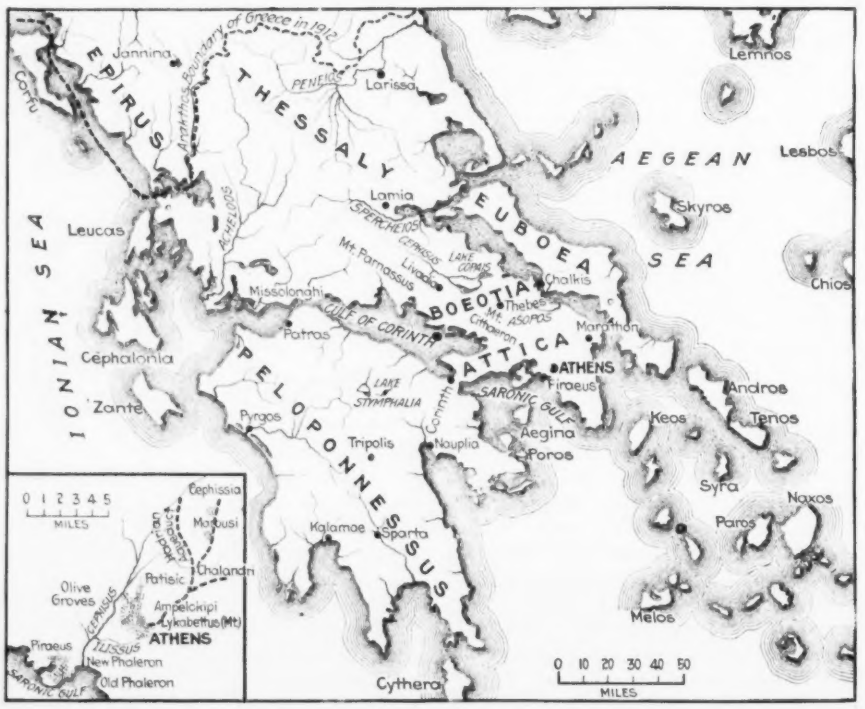


FIG. 1. THE KINGDOM OF GREECE BEFORE THE BALKAN WAR

Climate and Hydrology.—The Kingdom of Greece as constituted before the Balkan wars, comprising the lands first liberated from the Turks in 1829 and that portion of Epirus and Thessaly, ceded in 1881, lies between 36° 30′ and 40° north latitude, corresponding to that section of our Atlantic coast between the southerly limits of Virginia and the city of Philadelphia. Greece has, however, an entirely different climate from this part of our country, somewhat warmer and very much drier, more like the climate of portions of our Pacific coast or the semi-arid southwest. A sketch map of southern Greece is shown in Fig. 1.

Temperatures—Athens, the capital of Greece, located near the sea on the Saronic Gulf, is in about the same latitude as Washington, D. C. The Greek capital has a long, hot summer from June to September, inclusive, but suffers no higher extremes of temperature than our capital. The winter in Athens is, however, less severe. It never freezes there nor elsewhere in southern Greece near the sea and snow seldom falls. Back in the mountains, however, it is naturally cooler in both summer and winter and, at an elevation of 2,000 ft. freezing temperatures are common and the winter climate more nearly resembles that of our Atlantic seaboard in the same latitude. The high summer temperatures in Athens are less trying than those of Washington, with

FIG. 2. ST. ELEOUSA SPRING AT HEADWATERS OF BOEOTIAN CEPHISUS

This spring has a flow of from 5 to 100 sec.-ft. or more.

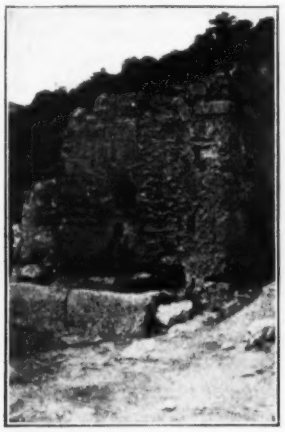


FIG. 3. FOUNTAIN ON ROAD OVER MT. CITHAERON

its greater humidity, and the winters in Athens would be more agreeable than in our capital if adequate provisions were made to heat the hotels and houses. According to our standards, the Greeks are not overfond of ventilation, even in warm weather, and in winter they wish little or none. The vitiated atmosphere of inadequately heated and poorly ventilated houses cannot be healthful, even for as hardy a people as the Greeks.

Rainfall and Humidity.—With respect to the amount and distribution of the rainfall and the humidity, the climate of southern Greece differs in a marked degree from that of our Atlantic seaboard. In Athens the average rainfall is only 15.5 in. and this occurs mainly during the months of October to May inclusive. Only in the mountains at El. 3,000 ft. or more, does the annual precipitation approximate that on our Atlantic coast but, even in the mountains, the rainfall during the summer is light and is limited to local showers.

The amount of humidity during the long, almost rainless summer is exceedingly small throughout southern Greece. The sunlight there has a brilliancy unknown in this part of the world, the stars seem as near and bright as in the desert, and, generally speaking, there is no dew. Under these moisture conditions, the high summer temperatures are more endurable than here and, but for the dust, the climate in the summer should be healthful. High winds are, however, frequent; barren, rocky hillsides are only imperfectly covered with vegetation; large areas of dry soil are left exposed by the summer harvest; the roads and unpaved streets are usually deep in dust, and, in consequence, the air is generally filled with fine dust. This dust causes the visitor much discomfort and may cause some ailments of the respiratory organs, even among the natives. The effect upon the nervous system of the intense sunlight, the hot winds and a relative humidity sometimes as low as 15 per cent, is hardly a matter for an engineer to discuss. These conditions give the visitor from a northern climate a constant feeling of irritability and may account for the nervous, emotional and capricious temperament of people exposed to them for generations.

That the climate of Greece, before the Christian era, was more favorable than now is suggested by some evidence there of a slightly greater rainfall in antiquity and it was probably somewhat cooler and cloudier then. Evidence of such a change in climate in that part of the world has been noted by Professor Huntington ("Pulse of Asia," etc.) and others in Asia Minor, Syria and Egypt.

Hydrology.—Greece is a mountainous country, at once beautiful and, in its general aspects, barren and rocky. Neither the topography, the soil nor the rock structure of the country is favorable to conserving a large proportion of the scanty rainfall. About the only water available, during the summer, for any purpose comes from the winter and spring rains that are stored as ground water in the fissured limestones that make up the mass of the mountains, in the occasional interbedded layers of schist or shale, and in the still more uncommon strata of sands, gravels and conglomerates of the larger valleys. Such stored ground waters, which for the most part appear as small springs, are here and there concentrated in the underground channels of the limestone into large flows, as illustrated in Fig. 2, a photograph of one of the large springs representing the principal source of the Boeotian Cephisus on the north side of Mount Parnassus. Taking the country as a whole, such large springs are by no means common and the aggregate amount of all spring flows is small. A high percentage of the rains that fall upon the steep mountain sides and upon the fine clayey soils of the valleys runs off quickly

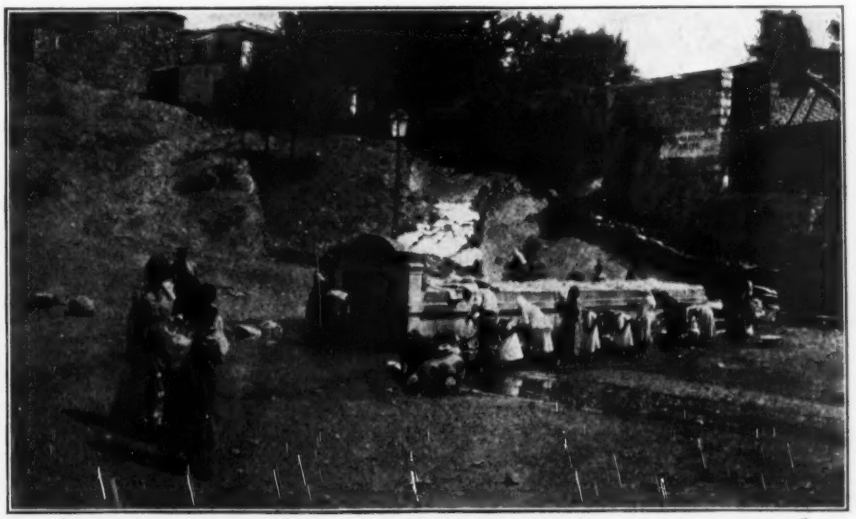


FIG. 4. FOUNTAIN ON THE OUTSKIRTS OF THEBES

into the sea and only a relatively small amount enters the ground. Because of the generally unfavorable conditions for the storage of ground water in the formations noted above, the underground storage becomes greatly depleted at the end of a long, dry summer and the amount of water available in the flow of springs is correspondingly small. In all Attica, for example, there are only two rivers that do not dry up by early summer and this statement applies to rivers with drainage areas of as much as 100 sq.mi., rivers that during the winter become impassible torrents. Throughout the country, lakes and ponds are few and favorable opportunities for artificially creating large surface reservoirs are rare. So far as known, conditions are nowhere favorable for pumping large volumes of water from the ground; bodies of coarse-grained sandstone or other porous rocks and deep beds of coarse sand and gravel, in which ground water storage might be developed, do not exist.

Water Supply

In a country so poorly supplied with water, the problem of providing a sufficient amount for large urban populations is a more serious one than in our more favored land. Without irrigation, agriculture in Greece is impossible during the summer and every drop of water not required for the needs of men and animals is, therefore, applied to the land. The diversion of springs for new public water supplies means a corresponding reduction in the amount of food produced and Greece does not grow enough food for her own needs.

Development of Surface Water.—The obvious solution of the problem of insufficient water is to develop the surface run-off that now goes to waste in the sea. This solution, however, has its difficulties. In the first place, most of the mountain valleys are narrow and steep and do not lend themselves to the creation of adequate storage reservoirs; even where the topography offers the necessary volume of storage behind a dam of reasonable height, there would remain in most localities the difficult problem of making the reservoirs tight, because the walls of most of the valleys consist of seamy, fissured limestone and there are frequently underground channels in the rock of some magnitude. Some very promising reservoir sites exist, however, and considerable storage could be developed for either water supply or irrigation needs. Where such surface water could be used to replace ground waters that are now being utilized for irrigation, no difficulty would arise. A proposal, on the other hand, to use surface water, or "rain water" as the Greeks speak of it, as a public water supply would meet with some opposition. Even among the more intelligent Greeks, there appears to be a strong prejudice, perhaps an age-long inheritance of these people, against the employment of any water for domestic use, except that from springs and wells.

Use of Ground Water.—In a country as hot and dry in summer as that of Greece, it is but natural that a cool sparkling ground water makes a strong appeal as a domestic supply. There is very little ice in Greece and the people drink a surprisingly large amount of water. Without our modern means of purifying surface waters, the ancients rightly chose ground waters for the supply of their cities and most of the cities of the Mediterranean are still so supplied. Whether the confidence of the ancient Greeks in the purity of the ground waters from the fissured limestones of their country or from their open wells was ever misplaced history does not tell us. Certain it is that disease often stalked through the land and it may have been spread sometimes by impure water supplies. The open well with its imperfect protection, from which many people still draw their supply by means of a bucket and a rope, must in times past as now, have been a source of infection. Some of the public ground water supplies in Greece are not today as safe as a surface water may readily be made; some of these supplies are quite as warm in mid-summer as a surface water when delivered to the consumer and all are harder than a surface supply would be, if drawn from the same locality.

Methods of Distribution.—During antiquity, the flow of springs and galleries was carried to constantly flowing fountains, to which all could go for their water. Only the privileged few had water in their homes. When only such lead pipes as the ancients had were available for large distribution mains, water in closed spigots under considerable pressure was, of course, impossible. It is of interest to note that the method of distribution in freely flowing fountains is still almost universal in Greece, although iron pipes instead of lead are used. A curious type of fountain in the smaller towns and villages, where shade trees exist along the streets, consists of a half or three-quarters inch supply pipe, which is carried up the back of a tree in a vertical groove made for the purpose, and afterwards covered with a strip of metal, and which is taken through the tree, at a height of 3 to 4 ft. above the ground, to an outlet on the street side. A more common and substantial type of construction is of masonry, a solid mass of rubble or ashlar 4 to 5 ft. high, with one or more outlets in the face, each discharging 5 to 10 gal. per minute, either into a small circular stone basin projecting from the face of the fountain just below the outlet or into a larger trough or basin on the ground below. A fountain with a Turkish inscription, on the road over Mount Cithaeron between Attica and Boeotia, is seen in Fig. 3. This is near ancient Eleutherae, the fabled birthplace of Bacchus. The spring back of the fountain appears to be that mentioned by Pausanias as the place where Antiope, the Theban princess, left her babies.

Rate of Consumption

A larger fountain on the outskirts of Thebes in the valley of the ancient Ismenos is shown in Fig. 4. This is fed by the spring of St. Theodorus, anciently called the Oedipodeia, because Oedipus was believed to have purified himself there. The laundry work of the neighborhood was evidently being done at this fountain.

The obvious advantage of a constantly flowing fountain is that of always providing a supply of water at a low temperature, an important consideration in a hot climate where no ice is available. Of course, all the water not carried away for use in the houses or used at the fountains for washing is apparently wasted, but the waste, after all, is more apparent than real, since all water that flows away from these fountains is utilized for irrigation in the village gardens or in the fields beyond. As long as the minimum yield of the sources of supply is largely in excess of the actual water supply needs of a community, it is not apparent that any better plan of distribution could be devised. It is probable that in the small Greek towns such water supply needs do not exceed 5 or 6 gal. per capita daily. When, in the future, they begin to pipe water to their houses and the

daily public and private use of water increases to 40 or 50 gal. per capita, the average of Mediterranean cities, the system of freely flowing fountains will naturally disapepar, as it has already done in Athens.

Water Supply of Athens.—Water-works of some importance were built in the past, both in the days of classic Greece and in the period of Roman domination. Those built in Athens during Roman times are still in use, and it may be of interest to trace the development of water supply in that city from the earliest times.

Springs at some elevation on the Acropolis and other hills within the bounds of the old city of Athens no doubt attracted settlement on that site and represented the first water supply. Subsequently, wells penetrating the limestone to the impervious shale below furnished additional water in some parts of the city and this supply, it appears, was supplemented by rain water stored in underground cisterns. Long galleries were sometimes driven from the wells in the limestone to increase the amount of ground water infiltration and investigation has disclosed some of these galleries of great length.

Ancient Works

One of the best known of the ancient public fountains was the "Old Hallirrhoe," on the hill of the Pnyx, which was evidently fed by a spring in a rock-hewn chamber in the hillside behind it. Near this fountain was the "Enneacrounos," the nine fountains supplied through an adjacent reservoir in the rock by the aqueduct of Pisistratus, a conduit that was built in the 6th century B.C. from the valley of the Ilissus, for the most part as a rock tunnel. An earlier aqueduct from the direction of the Acropolis may have furnished a supply to these fountains before the aqueduct of Pisistratus. In the second century of this era, the Roman Emperor Hadrian, who did so much for Athens and Greece, began an aqueduct, still known by his name, which was finished by his successor, the Emperor Antoninus Pius. This aqueduct, which still furnishes the major part of the supply of the modern city, has been located from the present terminus on Lykabettus, the conspicuous hill within the present city but outside the ancient town, to the suburb of Ampelokipi and thence northerly to the valley of the Cephisus and northeasterly to the slopes of Pentelikon and Hymettus. The total length of the aqueduct, as far as known, is about 16 miles and for most of this distance it is really an infiltration gallery. It was driven as a tunnel, partly in limestone, partly in earth and partly in the porous limestone conglomerate that occurs as lenses in the semi-impervious alluvium valley and about the slopes of the limestone mountains noted above. At the end of the aqueduct, on Lykabettus, are two small reservoirs of 340,000 gal. capacity, representing the only storage in the entire system and but one-ninth of the average daily supply. The face of the structure over one of these two reservoirs is seen in Fig. 5. Semicircular barrel arches form the roof above the reservoir.

At present the Hadrian aqueduct, with some wells in the rock at Kokinari near Cephissia, provides an average supply of 2.8 m.g.d., but the minimum summer yield is only 1.85 m.g.d. Incrustations of lime on the walls of the aqueduct have greatly restricted its cross section and reduced its carrying capacity. The municipality has recently been engaged in cleaning the aqueduct and a drift is now being driven above a portion of its channel to give access for cleaning and enlargements.

In addition to the supply from the Hadrian aqueduct, the city purchases a small supplemental supply for the northerly portion of the city from the owners of some open wells just north of Patisia. These wells give on the average an estimated supply of about 700,000 gal. per day, but this falls off to a minimum of about 30 per cent less than the above. Imagine what it means for a city of 240,000 inhabitants to have during a hot, dry, Attic summer, but 2,500,000 gal. of water daily, or only a little more than 10 gal. per capita, for all purposes. In consequence of this shortage, there is often insufficient water with which to flush the water-closets in the hotels and houses. Except for one district, occupied by the legations and the larger hotels, which is continuously served, each of the six separate services, through which the Hadrian aqueduct supply is distributed, receives water in turn for a few hours daily. The mains in the higher portions of the city are empty most of the time and, in consequence, they become filled with deposits of lime from the hard water. A supply of water is not delivered to the houses of the poorer classes; public spigots are provided in the streets for them and some of these spigots run constantly when water is available.

The scarcity of water in Athens would expose the city to a serious conflagration hazard but for the fireproof type of building construction—stone walls and tile roofs. Several fires occurred, last year, but they were confined to the buildings in which they originated. Fire hydrants, so conspicuous a feature of the streets of our American cities, are almost unknown in Athens. A fire engine is accompanied to a fire by a motor truck carrying a tank full of water with which to put out the blaze. This equipment was also used to restore order during the rioting in the streets that occurred prior to the last national election.

Quality of Supply

The quality of the public water supply of Athens is not such as to be acceptable in this country, because of its high mineral content. The supply from the Hadrian aqueduct has a total hardness of 378 p.p.m., practically all carbonates, and a chlorine content of 62.2 p.p.m.; otherwise, it is satisfactory, moderately cool, about 60° F., low in organic matter, attractive in appearance, and without sensible color, taste or odor. The supply appears to be naturally well protected from surface pollution and seems perfectly safe to drink except at such times as work is being done in the galleries. The supplementary supply from the wells near Patisia has a somewhat smaller mineral content than that from the Hadrian aqueduct but the large open wells are more exposed to pollution. The public supply is not used in Athens by the well-to-do for drinking water. They purchase water for this purpose in earthenware jars of 2 to 3 gal. capacity, which are brought in daily from springs in nearby villages. These spring waters are of excellent quality at their source, the jars are sealed when filled, but they are not sterilized and are constantly interchanged among the consumers, so that the opportunity for carrying disease is great. All this water is, of course, warm when delivered and the Hadrian aqueduct supply is over 70° F. in July and August, as it comes from the tap in some parts of the city. Ice is used to some extent for cooling the drinking water but those who cannot afford this luxury keep their drinking water cool in the customary way of the East by placing it in

FIG. 5. ONE OF TWO COVERED RESERVOIRS ON MT. LYKABETTUS AT END OF HADRIAN AQUEDUCT, ATHENS

porous jars. Sufficient water escapes through the walls of the jars and evaporates to lower the temperature of the whole. In hot weather, however, when the air temperature is above 90° F., water in these porous jars is seldom cooler than 75° F. This is rather warm to drink until one becomes accustomed to it.

The subject of an additional supply of water for Athens has been agitated for many years. The source of supply that has received most consideration is the group of springs at El. 2,000 ft. near Lake Stymphalia, in the Peloponnessus, about 70 miles in a direct line from Athens. The large springs at the headwaters of the Melas River in the Lake Copais basin have also been proposed, but these springs are low, only 300 ft. above sea level, and would have to be pumped. Another source of supply that has been strongly advocated, and the one on which the writer recently reported, is a large group of springs at El. 1,000 ft. about 80 miles from Athens, on the northerly slope of Mount Parnassus and at the headwaters of the Boeotian Cephisus at the northwesterly end of the great Boeotian-Phocian-Locrian plain. The yield of all the above sources falls off materially in the late summer, and, for the Mount Parnassus sources, the writer proposed, in the absence of any underground storage, to construct about 15 miles from Athens a storage reservoir, in which to impound the larger winter flows of the Mount Parnassus springs for use in the summer months. With this storage, the Mount Parnassus sources would yield, throughout the year, about 20 m.g.d. Fortunately, the drainage area above the proposed reservoir near Athens has a sufficient area to provide a first supply of surface water of excellent quality, amounting to nearly 10 m.g.d., and the development of this source was recommended. The proposed surface reservoir would have considerable depth and, if not drawn too low, would insure a summer supply of an agreeable temperature. Aëration and filtration of this supply would probably be necessary.

Supply of Other Cities.—In Piraeus, the seaport of Athens, which has a population of about 130,000, the water supply conditions are worse than in Athens. About the same amount of water is supplied per capita, but it is of a poorer quality. In ancient times, the city of Piraeus is said to have been supplied by an aqueduct in the valley of the Cephisus. Now, a few open wells near the city, some of them so near the sea as to receive brackish water, provide a supply of 1.25 m.g.d., which is pumped to the Kastelli reservoir, a covered basin in the city of 2,640,000 gal. capacity, seen in Fig. 6. All water for shipping and much of that used for drinking in Piraeus is brought by boats from the island of Poros. About 80,000 gal. are supplied daily from that source. Of this amount, approximately one-third is used for household purposes and is sold from tank carts in the streets or distributed in earthenware jars, as in Athens. It is planned that the proposed new supply for Athens be shared by the city of Piraeus.

Corinth, the ancient city near the isthmus of that name, was supplied by local springs of some importance and by an aqueduct built by the Emperor Hadrian, which is said to have come from the springs at Lake Stymphalia. Little trace of it now remains. The present city of Corinth is not built on the site of the old one and obtains its water supply from local springs and wells.

Chalkis, a city of about 12,000 inhabitants, the capital of the island of Euboea, had an aqueduct in the days of the Venetians which supplied the city from small springs back in the mountains, about 20 miles away. Judging from the size of the small trapezoidal trough in the top of a section of this aqueduct, still standing in the city and seen in Fig. 7, the supply of water could not have been large. Now, most of the water used in the city is carted in large barrels from a spring near the sea, about two miles away.

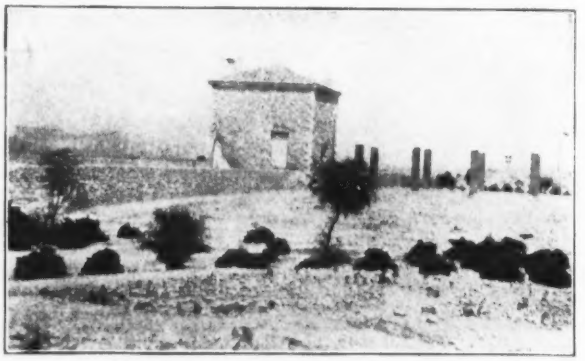


FIG. 6. KASTELLI COVERED RESERVOIR AT PIRAEUS

Thebes, the ancient capital of Boeotia, now a country town containing hardly 4,000 inhabitants, is well supplied with water by springs in the vicinity, which feed the many public fountains. That fed by the ancient Oedipodeia has been seen in Fig. 4. The Dircean springs, the most famous of the ancient sources, appear in the low hills about a mile south of the city. The ancient aqueduct, which served the Cadmeia or acropolis of the old city, the high ground to which the modern town is largely confined, was attributed to Cadmus, the legendary founder of the city. This aqueduct has not been traced to its source, but is said to draw its supply from springs on Mount Cithaeron, seven or eight miles away.

Sewerage.—The standards of cleanliness among the Greeks of the classic age were not high and, today, according to our ideas, there is still much room for improvement. The ancient Greeks had water but they did not keep their cities clean, and they retained the most primitive methods in the removal of human wastes. It is fairly probable, from what we know of the Greeks in the time of Pericles, that, in their concern for wealth and power and their interest in the higher attainments of life—in art, music and literature—sanitation did not

seem important to them. In their city life, the Greeks constructed beautiful public buildings and monuments still the admiration of the world, and built up a civilization that in many ways surpassed our own, yet they apparently accepted without protest their modest, uncomfortable dwelling houses, their narrow, dirty streets and all the stench and filth that must have accompanied the unorganized removal of human excrements by dry disposal methods. They were evidently content with the "squalid magnificence" in which they lived, or they would have effected some improvements, for the Greeks did well all things they attempted. The Greeks, however, were hardly less enterprising as regards the sanitation of their cities than other peoples of antiquity. If the purpose of the drainage system in the old Cretan palaces is correctly interpreted, the pipes and fixtures in the palace of Cnossus, built about 1500 B.C. by the predecessors of the Greeks, represented about the last word in sewage disposal until the modern system of water carriage was developed in western Europe, about 75 years ago. It is generally agreed that the few sewers of the ancient cities were built to carry storm water and to drain the land and that they were not primarily intended, at least not in Greece, for the carriage of house sewage.

Present Status of Sewage Disposal.—Modern plumbing has been introduced to some extent in Greece, but little or no progress has been made in the construction of municipal sewerage works. In a country where flies abound and few houses or even hospitals are screened, the absence of proper methods of sewage disposal and, more particularly, the common use by the poorer classes of open pits or privies, or of still more primitive means disposal of excreta in courts and streets, constitute a serious menace to public health.

Difficulties of Water Carriage.—Aside from the serious question of finding sufficient funds to do any public work, a difficulty that is not just now peculiar to Greece, the most serious obstacle to providing modern sewerage for the cities and towns of Greece is the difficulty of finding sufficient water. In some communities a system of water carriage would for this reason be impossible and some method of dry disposal would have to be adopted. To be successful, such a system would necessarily require the adoption by the people of habits of order and cleanliness that are now generally lacking. This would be more important than if water carriage were introduced, but a great deal of educational work would have to be carried on before any system of sewage disposal could be introduced.

Sewerage of Athens and Piraeus.—It may be of interest to speak of the sewers of ancient Athens, to outline the existing sewerage system and to briefly describe the proposed new works for Athens and Piraeus.

Several sewers, or, more properly speaking, storm-water drains, belonging to ancient Athens have been found. A drain from the Theater of Bacchus, near the Acropolis, leading to an outlet in the channel of the Ilissus, has been identified as of the 5th century B. C. The river Eradnus, which rose on the slopes of Lykabettus, was carried through the old city, first as an open ditch and later as a storm-water sewer, to a point of discharge near the old city gate, known as the Dipylon, where a portion of the sewer and a sluice-gate may still be seen. It is believed that some house sewage may have reached these ancient drains, but such use was probably limited, in the sense in which we use the term sewage as meaning water-borne wastes.

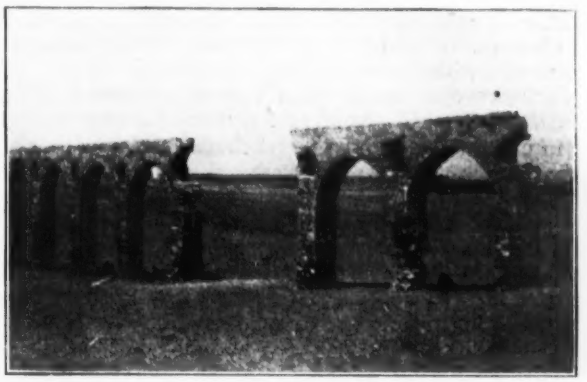


FIG. 7. REMAINS OF VENETIAN AQUEDUCT FOR CHALKIS, ISLAND OF EUBOEA

Only a part of the modern city of Athens is sewered. The existing sewers are of good size, 3 to 11 ft. of trapezoidal section, with semi-circular arch and constructed of rubble masonry lined with cement mortar. They have somewhat irregular sections and grades and were built for storm-water drains, to relieve the streets of the city of the floods of water that rush down from the adjacent hills, at times of heavy rain. In spite of legal prohibition, however, these sewers carry the house sewage of the limited districts served. Large areas of the city depend on cess-pools and open pits. In the poorer quarters of the city, wash water is often carried in the street to the nearest drain, as shown in Fig. 8. The house sewage of Athens is all discharged, at a locality known as Daniel's Church, into an irregular unpaved open channel within the limits of the city, whence it flows to the Cephisus. This channel and the end of the outfall sewer are shown in Fig. 9. During the summer, all the sewage in this channel is diverted for irrigation in the district known as the "Olive Groves," just outside the city; in the winter, most of it is carried by storm waters into the Bay of Phaleron. The city of Athens derives some revenue from the use of the sewage for irrigation. No vegetables to be eaten uncooked may, however, be grown on lands so irrigated. Considering how little water is available, it is not surprising that this sewage is strong and black. Its delivery in open ditches, frequently beside the roads, is very offensive during the hot summer weather.

Proposed Sewerage System.—The writer in his report of last fall recommended the construction of a separate system of sewers for Athens, as well as for the neighboring city of Piraeus and the villages of Old and New Phaleron, which are even less adequately served than Athens. The house sewage of these latter communities and that of a small area in Athens would have to be pumped into the main gravity outfall from Athens, in which all sewage, not diverted for purposes of irrigation, would be discharged in deep water in the Saronic Gulf, well off the beach at a point several miles from the nearest community served. In connection with this plan of disposal, it will be of interest to note that the city of Naples discharges all the house sewage of a population of 900,000 people into the Tyrrhenian Sea near the old city of Cumae, about 15 miles north of Naples. Except for coarse screening before the sewage reaches the pumps in the city, where most of it is lifted

sufficiently to carry it by gravity to the outfall, the sewage is untreated and is discharged on the beach at low-water level without creating any nuisance.

It is proposed to discharge the storm-water drains of Athens, in which the present system of sewers would be incorporated, into the nearest channels of the Ilissus and the Cephisus and to discharge the storm-water drains in Piraeus and the Phalerons directly into the harbor or the sea. Among other reasons for recommending a separate system of sewers, instead of a combined system that had been previously proposed by French and German engineers, it was believed to be impossible to prevent the accumulation, in a system of large combined sewers, of the sand and detritus that come down during the rainy season from the steep, rocky hillsides in and about these cities, and to avoid the nuisance that would occur, during the long, rainless summers, from the lodgment of fecal matter on such

FIG. 8. WASH WATER FLOWING IN A STREET OF ATHENS

obstructions in the sewers. The pollution of the river channels and the harbor of Piraeus by dilute sewage from the necessary overflows of a combined system, and the high cost of constructing and operating the larger pumping stations required in Piraeus for the combined system of sewers, were further considerations that influenced the decision in favor of a separate system. By utilizing the existing sewers, a measure that would not be practicable if a combined system were chosen, the cost of the separate system proposed would be no greater than that of a combined system. The early construction of sewers in Athens and Piraeus is most necessary, yet, if a system of water carriage is to be introduced and such a system seems best under the conditions existing there, nothing can be done until a sufficient supply of water is assured.

Other Sanitary Problems.—The furnishing of sufficient water of good quality and the satisfactory disposal of the human wastes in the cities and towns of Greece are, of course, only two of sanitary problems there. Besides the prevalence of typhoid fever and other filth diseases, one of the serious consequences in modern Greece of the general lack of cleanliness, so common in the Near East and in the Mediterranean, is the high infant mortality. This is a question that is bound up with the general problem of clean food and the proper care of infants and is now receiving the earnest attention of the Greek Government, with which the American Red Cross has been co-operating.

The presence of the flea and the bedbug, the constant evidence in Greece of uncleanliness and poor housekeeping, makes the life of a visitor from a cooler, cleaner land a most uncomfortable one, even though he may not receive any disease through their bites. That these insects, particularly the flea, may be important, however, in transmitting certain diseases is recognized, even if no country-wide aversion to them seems to exist. Bubonic plague has frequently been a visitor in the Piraeus and the fumigation of the Athens sewers with sulphur dioxide to kill the rats was observed last fall.

FIG. 9. UNPAVED CHANNEL AT END OF ATHENS SEWER

The removal of garbage and rubbish in the city of Athens appeared to be as well done as in many of our own cities. The violent ringing of a gong on the garbage carts in Athens at 6 o'clock on a summer morning is hard on light sleepers who, unlike the Greeks, sleep with their windows open, but the ringing is effective in getting out the garbage. This material is fed to hogs; rubbish and ashes are carried to dumps outside the city.

The prevention of dust in the cities and towns, already referred to, must wait upon the delivery of sufficient water with which to sprinkle and flush the streets. The construction of hard pavements, both in the cities and in the country, will improve conditions in this respect. The continued construction of water-bound macadam roads without surface treatment has nothing but economy to recommend it in that climate.

Malaria Prevention.—The gravest public health problem in Greece, today, is the high prevalence of malaria. This disease is a more serious ailment there than ordinarily encountered in our climate. As observed last year in the men of the writer's organization, it is characterized by a high fever with vomiting and severe pains. Under the most effective treatment of daily sub-cutaneous injections of bi-chloride of quinine, the fever lasts several days and may recur if large doses of sulphate of quinine are not taken internally for some time afterward. Quinine prophylaxis just prior to or during exposure does not always appear to be effective.

Some published figures indicate that, before the war, from one-third to one-half of the whole population of Greece had the fever annually, and that in some districts all the people had it every year. That malaria, if neglected, may lower the vitality and lead to more serious disease, such as tuberculosis, can be readily believed. That it must result, throughout Greece, in a great loss of man power is evident, and this loss occurs when labor can least be spared.

According to Ross ("The Prevention of Malaria"), Greece may have suffered seriously in the past from this disease, although the evidence is not conclusive. He believes from references to malaria in the literature of early Greece that malaria was probably introduced into that country during the 5th century B. C., by soldiers or slaves from abroad and that the ravages of this disease may account for the depopulation of Greece, which occurred between the 5th and the 2nd centuries B. C., and which has not previously been satisfactorily explained.

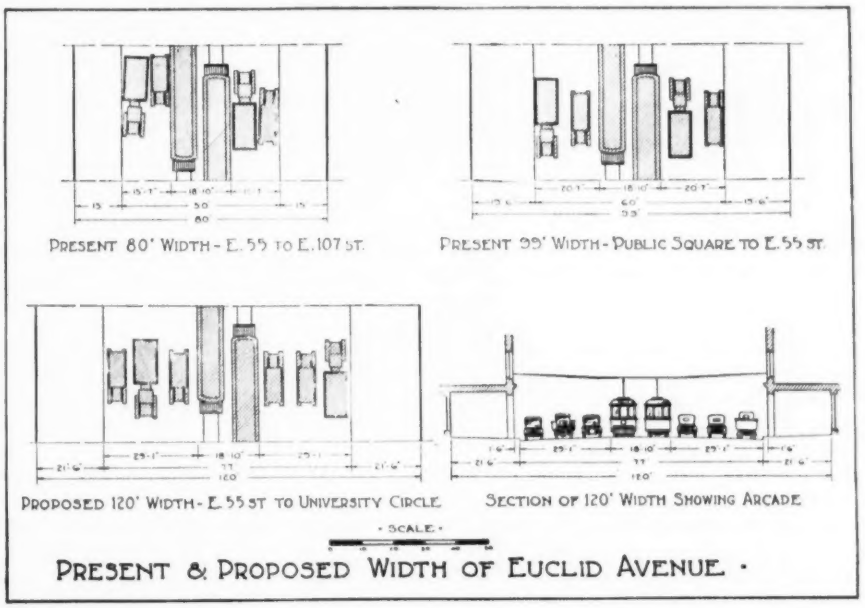
Lack of Drainage.—It is not surprising that the villages in the Plain of Marathon should have, it is said, more malaria than any other district in Southern Greece, because of a constantly flowing stream and the extensive swamps there, beside the sea, into which the Persians were driven in their defeat, 490 B. C. Nor is it remarkable that one of the worst districts for malaria is that in and about the basin of Lake Copais in Boeotia, which an English company drained about 20 years ago and now keeps fairly well pumped out. The floor of the old lake is nearly level and there remains, even in midsummer, much stagnant water about the basin and large areas of marshy lands, that are constantly flooded by the flows of tributary springs. There are some other districts which form natural breeding grounds for mosquitos, such as the picturesque mountain valley of Lake Stymphalia, which is subject to large changes in elevation when the drainage tunnel through the mountain, said to have been driven by the Emperor Hadrian, becomes obstructed.

Such large areas of wet ground as those mentioned above are not common in Southern Greece, however, and it seems curious, at first sight, that a country that is in general so mountainous and, for four or five months of the year, so rainless and dry, should have so many mosquitos and, in consequence, so much malaria. This situation must be explained by the existence of numerous small springs throughout the country and of many open wells and shallow storage tanks, the very complete application of all available water to fine, semi-impervious soils, the absence of any effort about the springs and wells and along the irrigating ditches to avoid stagnant pools and wet ground, and the almost universal lack of screens in dwelling houses. Even in the city of Athens, in districts that are naturally as dry and dusty as can be imagined, the mosquito is very annoying, although there is comparatively little malaria. The mosquitos apparently breed there in the uncovered water tanks on the roofs of buildings and in the many gardens, where some water is constantly being used.

The Greek Government has been at work on the problem of lessening the ravages of malaria. It has issued literature to educate the people, has bought and dispensed quinine, and, in some districts, taken active measures against the mosquito in the direction of draining and oiling, and has even given treatment to the people. Such work can hardly be considered much more than a beginning. The greatest problem appears to be that of educating the people to some realization of the necessity of taking radical measures to eliminate the mosquito—no small task among a conservative and ignorant peasantry. It may be assumed that the last eight years of war have greatly interfered with the anti-malaria work that the government has been doing. Large drainage projects have recently been under consideration, but their object is primarily to increase the area of cultivable land, rather than to combat the mosquito.

Plan for Widening and Arcading Parts of Euclid Avenue, Cleveland

AS A PART of its thoroughfare plan (*Engineering News-Record*, March 3, p. 382) the Cleveland City Plan Commission proposes the widening of Euclid Ave. from E. 55th St. to University Circle, a distance of over two miles. Euclid Ave. is now 80 ft. wide in this section. It is proposed to widen it to 120 ft. by taking 20 ft. from each side. While most of the frontage is now improved with residences standing well back from the street line, three important sections have been developed with business buildings coming clear out to the present street line. A number of these buildings are substantial structures, and in order that the widening may be effected at a minimum expense it is proposed to leave the present buildings standing but to push back the store fronts on the first floor and run the sidewalk in an open arcade along and under the front 20 ft. of the present buildings. This will leave almost the entire width of the present street, 80 ft., for roadway purposes. The arcade plan will be applied to about 10 per cent of the frontage along the two-mile stretch proposed for widening. Robert H. Whitten and Froule R. Walker are advisers and C. E. Conley is engineer of the City Plan Commission, and Robert Hoffman is city engineer.


PRESENT 80' WIDTH - E. 55 TO E. 107 ST.
PRESENT 99' WIDTH - PUBLIC SQUARE TO E. 55 ST.
PROPOSED 120' WIDTH - E. 55 ST. TO UNIVERSITY CIRCLE
SECTION OF 120' WIDTH SHOWING ARCADE
SCALE
PRESENT & PROPOSED WIDTH OF EUCLID AVENUE.

Steel Shops of Samson Tractor Co. at Janesville, Wis.

Double Faced Sawtooth and M-Truss Roofs—Crane Runways Suspended From Foundry Roof Trusses—Yard Cranes

ROOF framing designed to carry fixed and moving loads with economy of material, double faced sawtooth roofs and supplementary tension members in trusses carrying trolley and crane runways, are features of the large new plant for the Samson Tractor Co. at Janesville, Wis. An extensive equipment of mechanical handling systems in the buildings and yards includes conveyors, trolley hoists and overhead cranes. At present the plant consists of a machine and assembly shop, foundry, heating plant and two-story office building, but provision is made for additional shops and foundries.

The machine shop, Fig. 1, a one-story steel-frame structure 400 x 500 ft., was built in two units of practically equal size, each having an office building 40 ft. wide across the front. Each unit is divided transversely into six 30-ft. bays, with longitudinal spacing of 40 ft. for the columns. The roof framing consists of 30-ft. sawtooth trusses supported on columns and spaced 40 ft. c. to c. Between each pair of trusses on columns are three intermediate trusses of 10-ft. spacing, supported by inclined longitudinal trusses in the plane of the sawteeth. In erection, the 30-ft. trusses were placed first, then the inclined longitudinal trusses, and finally the intermediate trusses.

In the first unit of the building the steel framing is designed for ordinary roof loads. In the second unit, a heavier design was employed, with stiffer bottom chords and heavier bracing in order to take care of possible future loads due to shafting and monorail tracks. It is pointed out by the designer that in buildings of this kind, such appliances are likely to be attached to the roof, whether or not the design has provided for them, and they may add a considerable percentage to the calculated load. The trusses and framing were designed specially with a view to provide for these roof loads without excessive weight of material. Further, to facilitate the placing and shifting of motors and shafting and their rearrangement at any time, the bottom chord of each truss is made of two channels set far enough apart to allow of slipping attachment bolts between them.

For the central bay, forming the assembly shop, a Pond or M-truss construction is used, as shown, this arrangement giving exceptionally good ventilation. With this roof design there is a good distribution of light over the entire floor, and although the sawteeth face both north and south there has been no complaint on account of the direct sunlight from the south. Reinforced-concrete roof slabs are used in the first unit and gypsum slabs in the second unit. Details of the sawtooth and M-truss design are shown in Fig. 2.

An essential point which was impressed upon all connected with the design and construction of the building was the necessity of keeping the shop floor clear. The six toilet and locker rooms therefore are arranged in pent houses at the roof level (see Fig. 1), with iron stairways from the floor. These rooms are of concrete with metal fittings, so that they can be washed out with a hose. Of the two large fans for a supplementary heating and ventilating system, the first was installed on the floor, but proved to be such an obstruction that it was raised above the roof trusses, the second fan being installed in a similar position. For the main steam heating system cast-iron radiators are placed on the trusses as well as on the side walls. These conditions illustrate the unforeseen loads that roof trusses may be called upon to carry through the necessity of accessory apparatus.

Foundation and Floors.—Plain concrete footings on coarse gravel are designed for the conservative loading of 3,500 lb. per square foot. A bearing test showed that the gravel would carry 10,000 lb. without excessive settlement. It is pointed out that in view of the unexpected loads which are likely to be placed on parts of a building of this kind when it is in service the designer may be glad to remember that he has an ample margin of safety in the foundations.

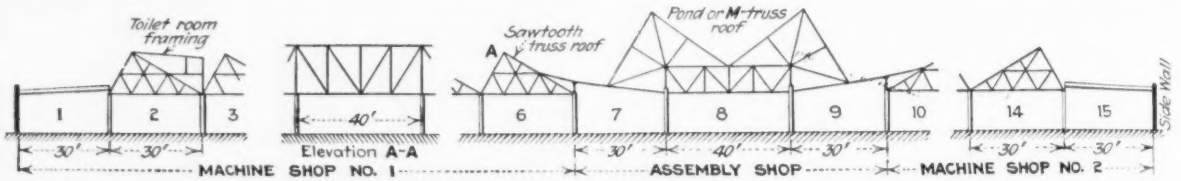


FIG. 1. CROSS-SECTION THROUGH MACHINE SHOPS AND ASSEMBLY SHOP OF SAMSON TRACTOR CO.

Stepped footings were designed, but for the first unit the contractor was permitted to build a footing course carrying tapered piers, wires embedded in the footing being attached to the forms so that they would not rise when the concrete was poured. Reinforced footings with vertical pedestals were used in the later buildings, the contractor's superintendent claiming that the expense of reinforcement was less than that of tieing or weighting the pyramidal forms to hold them in place.

The machine shop floor is of ⅛ x 2¼-in. maple strips dipped in hot paraffin oil, these being laid diagonally on 3 x 6-in. hemlock planks dipped in creosote. These planks are on a 1-in. layer of Tarrock with a 6-in. concrete base over a 4-ft. fill of sand and gravel. This fill, made by dumping from small industrial cars, was not deposited in layers and was not rolled, but was carefully puddled. The concrete base was placed as soon as the puddling was finished, but no appreciable settlement has been noticed, although loads of 1,500 lb. per square foot are not uncommon under piles of plates and structural shapes. The maple floor is found excellent for storage and shop purposes, but soon began to wear badly where the sharp wheels of the tractors run over it continually between the assembly shop and the loading dock.

Asphalt blocks 2¼ in. thick laid in lean cement mortar are used to pave the reinforced-concrete loading dock and have given good service under the tractor wheels. This paving was tried in a part of the shop but was not

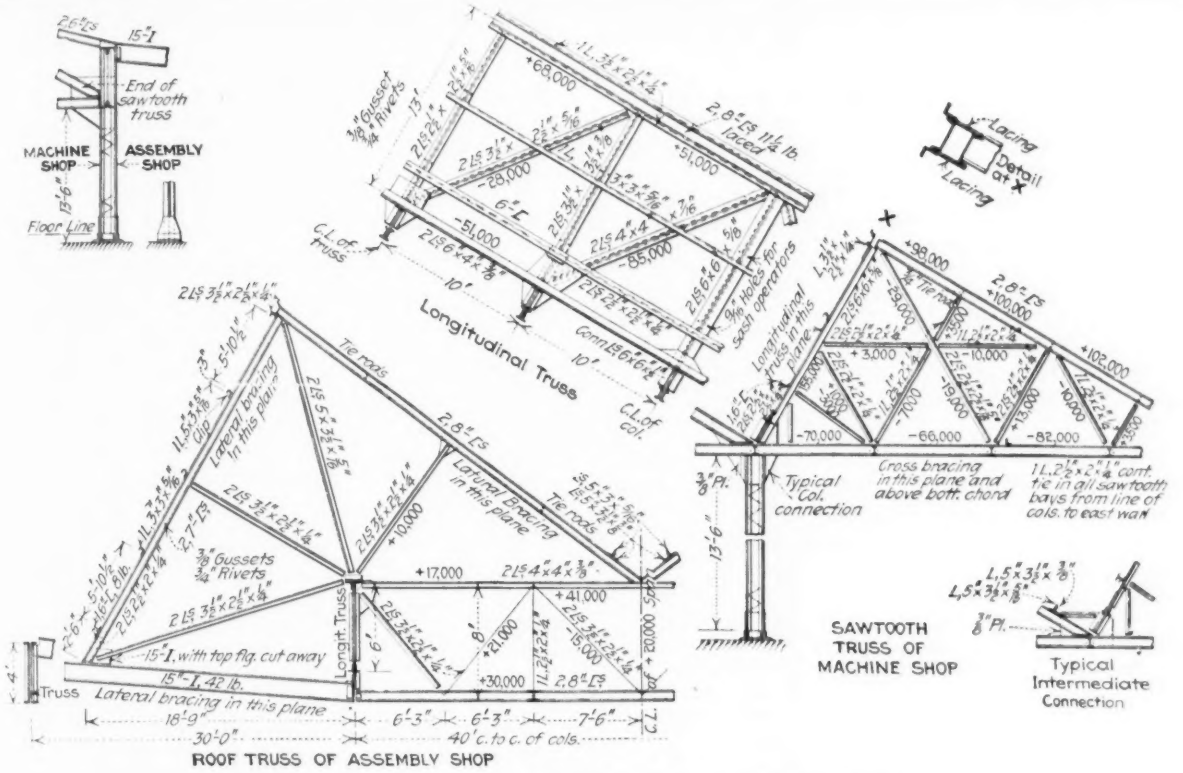


FIG. 2. ROOF TRUSSES OF MACHINE SHOP AND ASSEMBLY SHOP

satisfactory where it was exposed to the action of oil and gasoline droppings.

Foundry Building

A steel frame structure 330 x 530 ft. forms the foundry, which has a main floor about 130 x 500 ft. flanked on one sde by pattern shop, sand bin and core room, and on the other side by bins for pig iron and other supplies. Along the front extends a cupola building with heavy steel charging floor, and a three-story service building containing offices, wash and locker rooms and a pattern loft. Four rows of columns support parallel chord trusses, the columns of the two interior rows extending to the ridges of a double saw-tooth roof bay having movable sash on both the north and south sides, Fig. 3. Tar and gravel roofing is laid on the flat portions, the sloping Pond or M-truss roof being covered with two plies of felt and a 3-ply roofing.

An extensive system of monorails and overhead transfer cranes serves the foundry and is supported directly from the lower chords of the roof trusses and from steel hangers at a lower level (see Fig. 3). To permit of attaching monorails at any desired point the lower chord of each truss is stiffened by a continuous 12-in. web plate which is not figured in the chord section. Cast steel bolted clips were used at first to attach the monorail tracks to the trusses, but subsequently clips of structural steel were used and are said to answer the

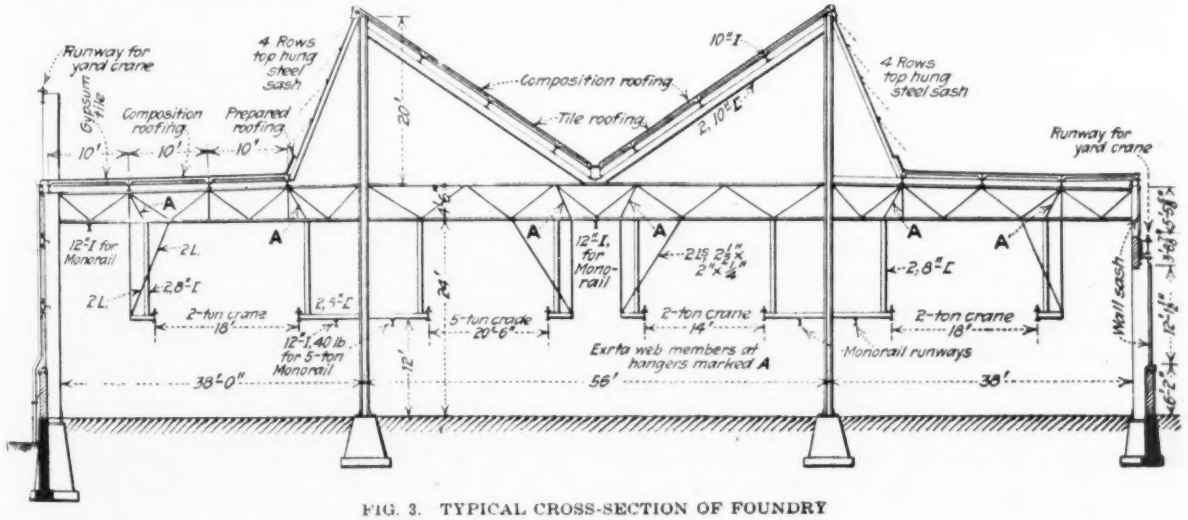


FIG. 3. TYPICAL CROSS-SECTION OF FOUNDRY

purpose equally well. Where hangers are attached to the lower chords between panel points, supplemental web members are placed to carry the loads to the upper panel points and thus avoid bending the chords.

Brick walls were planned for the cupola and service buildings, but concrete pilasters and brick panels were used on account of difficulty in obtaining a sufficient force of bricklayers. This change hastened the progress of the work materially. As bids on ironwork for stairways in the foundry indicated high cost and late delivery, a change was made to reinforced concrete, with a saving in cost and time, while the appearance is found to be satisfactory. Patent non-slip treads were difficult to obtain, and the surface concrete of the treads was finished by mixing carborundum in the proportion of 2 lb. per square foot. At the charging floor, designed for a load of 1,200 lb. per sq.ft., closely spaced I-beams

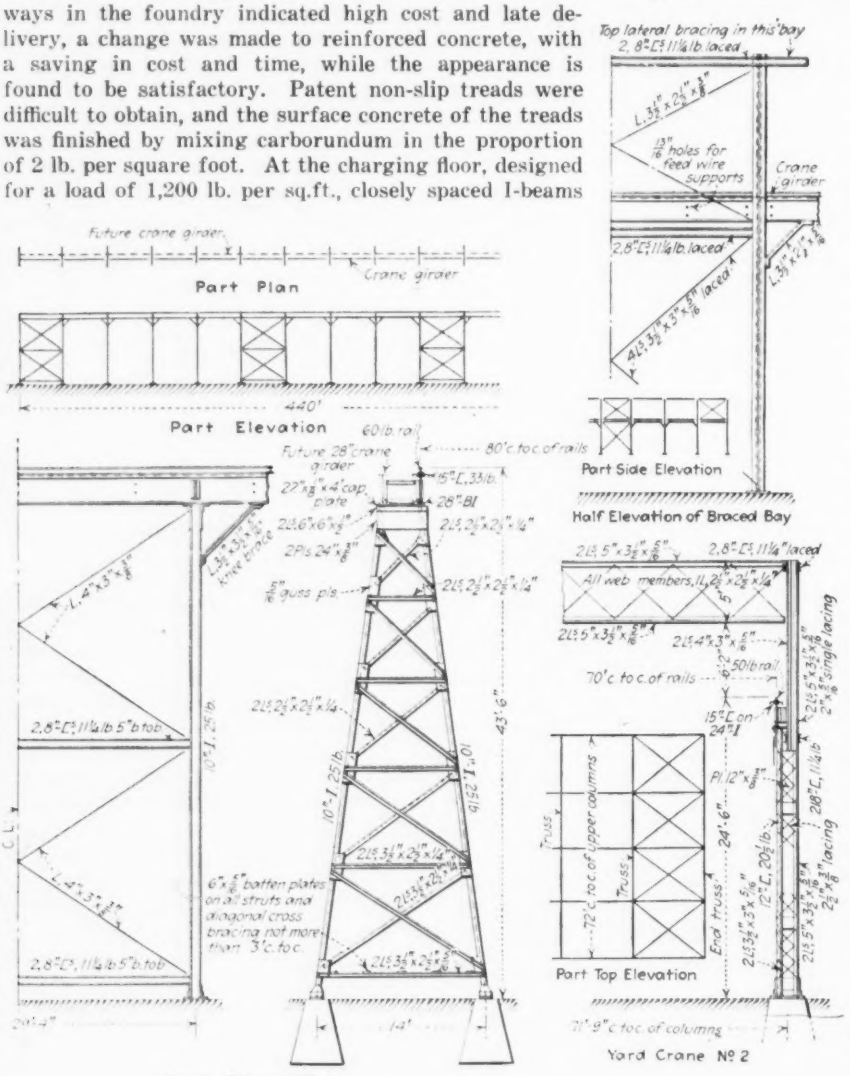

Future crane girder
Crane girder
Part Plan
440'
Part Elevation
60lb. rail
Future 28" crane girder
80'c. to c. of rails
15" I. 33 lb.
28" BI
2 Pls. 24" x 3/8"
5/8" guss pls.
43'-6"
10" I. 25 lb.
10" I. 25 lb.
9" I. 21 lb.
2.8" L's, 11 1/4 lb. 5" b. to b.
6" x 5/8" batten plates on all struts and diagonal cross bracing not more than 3' c. to c.
24'-4"
14'
Yard Crane No. 1
Top lateral bracing in this bay
2. 8" L's 11 1/4 lb. laced
13/16" holes for feed wire supports
Crane girder
2.8" L's 11 1/4 lb. laced
Part Side Elevation
Half Elevation of Braced Bay
All web members, 11, 2 1/2" x 2 1/2" x 1/4"
2.8" L's 11 1/4" laced
50 lb. rail
70'c. to c. of rails
15" I. on 24" #
Pl. 1/2" x
28" I. 114 lb.
Truss
72' c. to c. of upper columns
Truss
End truss
24'-6"
Part Top Elevation
71'-9" c. to c. of columns
Yard Crane No. 2

FIG. 4. RUNWAYS FOR YARD CRANES

are framed between I-beam girders and covered with ¾-in. steel plates.

As steel for the heating plant building was delayed by strikes, two 500-hp. boilers with automatic stokers were set in place before the superstructure was erected. These boilers were on the main floor, 16 ft. above the basement and supported by heavy concrete columns and girder beams. As soon as these beams were received, the erection of the boilers was begun and a wooden shelter was built over them. Steam pipes were hung temporarily and secured to the permanent structure later. This work was done in severe winter weather and added largely to the cost of construction, but the boilers were ready for service as soon as the building was enclosed, or at about the time that their erection would have been started ordinarily. A breakdown in the local electric plant occurred just then and these boilers, with a turbo-generator that had been installed in a similar manner, carried the entire plant load for several weeks.

Pipes for water-supply and steam heat are led from the power house to the buildings in a tunnel 10 ft. wide and 6½ ft. high, with its top 2 ft. below the surface. Pipe trenches in the buildings are covered with removable slabs of concrete about 4 ft. long, occasional slabs being provided with handles to facilitate removal. At doorways or partitions the concrete cover is cast permanently in place.

Yard cranes are provided for handling raw material, equipment and finished product. Two designs are shown in Fig. 4. The 5-ton crane of 80-ft. span has 28-in. I-beam runway girders supported by A-frame bents with a longitudinal spacing of 29 ft. 4 in., four pairs of the bents being connected by struts and diagonal bracing to form towers. The 5-ton, 70-ft. yard crane has posts built of angles and lacing up to the 24-in. I-beam runway; above which they are extended in smaller section to carry transverse trusses. These posts are spaced 26½ ft. and are connected by diagonal bracing at intervals.

Steel erection on the main buildings and crane runways was done mainly by locomotive cranes. At one time a strike stopped the assemblage of trusses in the shops, and in order to avoid delay the parts were shipped to the work and assembled during erection. This caused comparatively little delay. Concrete for the greater part of the work was made in a ¾-yd. mixer serving a 75-ft. tower with steel spouting suspended from cables and having a reach of about 500 ft. A ½-yd. mixer and small tower were used for the office building and portable mixers served various isolated sections. When concrete for the power house walls and other parts was placed during very cold weather, the materials were heated.

Design and supervision of construction of the entire plant were in the hands of Frank D. Chase, Inc., engineers, Chicago, the structural designs being made by G. W. Niestadt. H. S. Baker was engineer in charge, with F. M. Reynolds as superintendent of construction. The general building contract was handled by J. P. Cullen & Son, Janesville, Wis., and the du Pont Engineering Co., Wilmington, Del.

Curve Traverse Chart for Lining Track

By J. G. Wetherell
Assistant Engineer, C., M. & St. P. Ry.

In staking curves for relining track a curve traverse has been found of great assistance. The curve is first divided into 31-ft. stations along the outside rail, the stations being numbered and care being taken to have Station O on the tangent. A string is then stretched from 0 to 2 and the distance from the string to the rail at Station 1 is measured in inches, giving the degree of curve at Station 1. The string is then moved ahead and the degree of curve determined in the same way at each of the other stations. A chart can be plotted in the notebook, using one small square

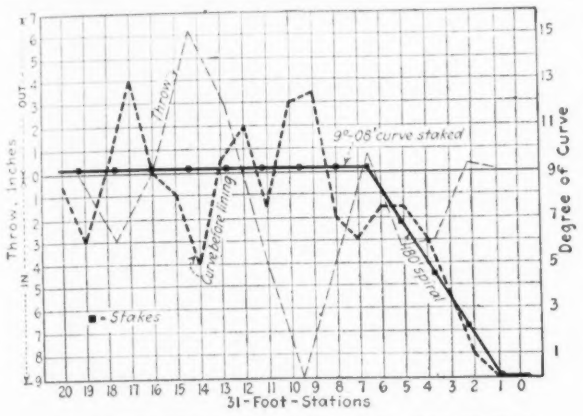


CHART OF CURVE TRAVERSE AND ADJUSTMENT FOR RELINING TRACK

horizontally for each station and one square vertically for each degree of curve.

The accompanying diagram is a chart of one end of a Y-track at Bardwell, Wis., which the writer recently staked. Remembering that a true, simple curve plots as a straight horizontal line, and a spiral as a slope line, it will be seen that there was a fairly good spiral on this curve about 125 ft. long, but that the rest of the curve was badly out of line, varying between 5 and 13 degs. From the appearance of the traverse curve it was thought that a 9-deg. curve would give a fair average of throw in relining, but after the first trial staking it was found that a curve of 9 deg. 8 min. was better on account of a turnout and a platform. This was established and spiraled as shown. Stakes were set every 50 ft., according to usual custom (except on the spiral) and the amount of throw was measured in inches at each stake.

These throws were plotted as shown, care being taken to equalize the stationing. It will be seen that the chart is a complete diagram of the curve, showing what it was, what it was to be, what throws were necessary, and how these throws balanced. Further, it will be seen that there is no definite relation between the traverse curve, the located curve and the throw, although the greatest throw comes where there is the greatest divergence between the first two.

The writer does not believe that a "degree of curve" traverse is of any use on long flat curves, except possibly at the ends, to quickly determine the conditions there. It is well, however, to traverse a short, sharp curve entirely, in order to study the curve as a whole and to avoid compounding.

The Riensch-Wurl Sewage Screening Plant at Santa Barbara

Special Pump Handles Screenings Which Are Spread on Ground With Street Sweepings — Constant Attendance Unnecessary

By Ormond A. Stone
With Olmsted & Gillelen, Los Angeles, Cal.

Topographical conditions and the original layout of the old sewer system so limited the possible locations of a main gravity outfall sewer at Santa Barbara, Cal., that it was necessary to locate the sewage works within three blocks of a widely-advertised, all-year-'round resort and within 100 yd. of the ocean-front boulevard, which is also a trunk line of the state highway. Thus a primary requirement was a means of treating the sewage from a city of 20,000 people without nuisance to adjoining property. Imhoff tanks were considered, but because of unfavorable sentiment were abandoned. A fine-screen plant was ultimately decided upon after it was determined that the operating methods of a similar sewage screening plant at Long Beach, Cal., could be improved and the costs lowered.

The Long Beach screen (*Engineering Record*, May 20, 1916, p. 664, and *Engineering News*, May 4, 1916, p. 836) requires the constant attendance of an operator to move the cans of screenings as they are received from the revolving brushes and to be available in case of failure of the automatically operated sump pumps.

Study of the operation of the Long Beach plant over a period of some three years indicated the possibility of certain improvements being made in future installations which would materially lessen the cost of operation. Most important of these was a method of storing and handling the screenings so as to eliminate the need of constant attendance except where, as at Long Beach, the attendant was needed for other purposes than caring for the screen.

Santa Barbara officials were advised that by delivering the screenings to a concrete storage sump from which they could be periodically removed, the plant would require but part time of one man to keep it in operation; also that a feasible means of disposal of the screenings, other than by incineration, was possible, thus making the cost of operation and maintenance compare favorably with Imhoff tanks. Accordingly, a plant was designed with the arrangement shown in the accompanying drawings.

Before determining upon the use of a centrifugal pump to elevate the screenings from the pit every conceivable alternative was considered. Restricted space and quicksand eliminated the practicability of a driveway under the pit; compressed air as a means of lifting the screenings was too expensive both as to first cost and operation; and bucket or belt conveyors were considered unsanitary.

Many of the larger pump manufacturers were furnished with the data and informed of the type of service desired, with the request that they advise if a pump could be supplied to meet the requirements. Without exception the replies were to the effect that the conditions were not adaptable to the use of a centrifugal pump.

Convinced that a centrifugal pump could be designed to lift the screenings as they came from the screen

and strengthened in this belief by correspondence with A. B. Wood of New Orleans, the writer finally prevailed upon the Byron Jackson Iron Works of San Francisco to supply a pump for this service.

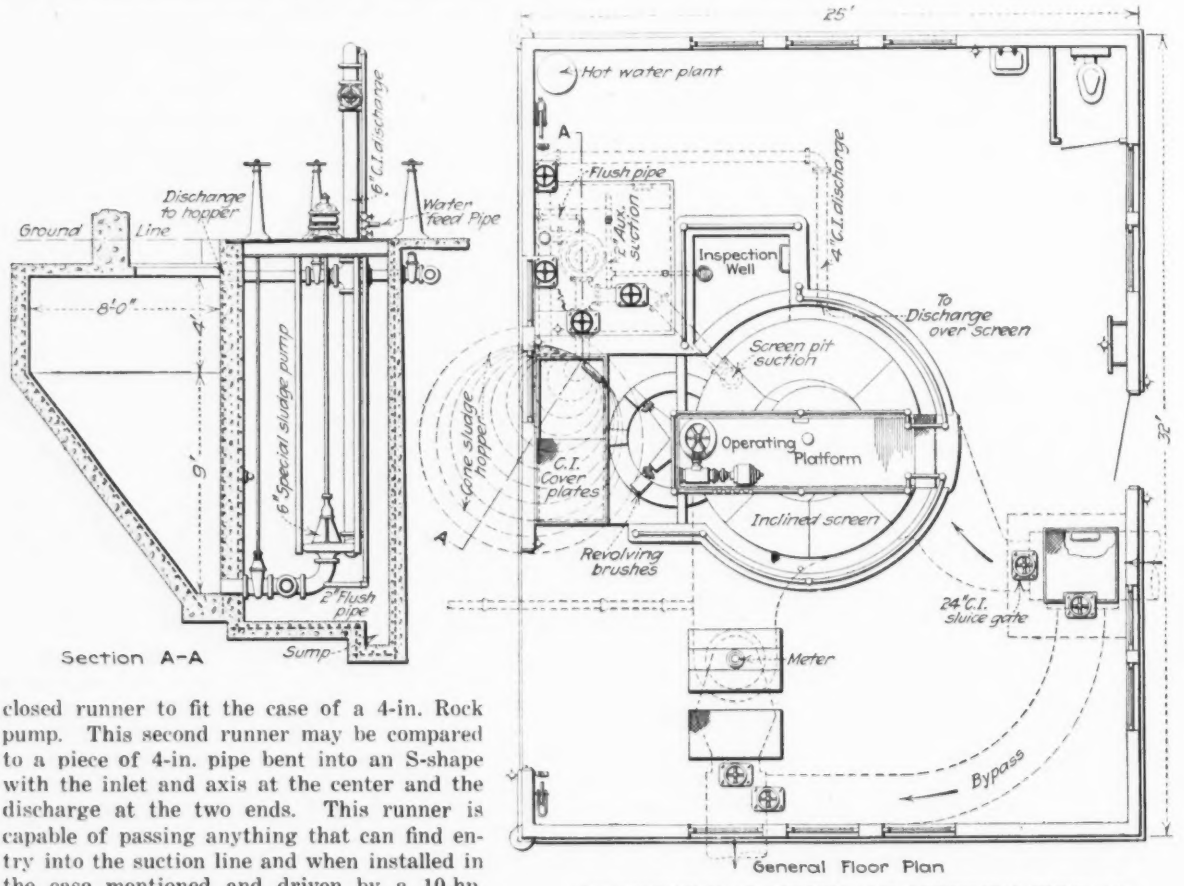
The first pump installed by them was a 4-in. vertical, centrifugal pump, having an open runner and driven by a 7.5-hp. motor. It was immediately apparent that this pump was unsuited to the conditions because rags and waste were wound up by the runner in such a way as to clog the suction. In attempting to empty the screenings pit for the first time, 22 gal. of rags and waste were removed from the pump, and a whole day was spent in an operation that should have taken but a few minutes.

A. C. Paulsmeier, designing engineer for the Byron Jackson Iron Works, next designed a special two-ported closed runner to fit the case of a 4-in. Rock pump. This second runner may be compared to a piece of 4-in. pipe bent into an S-shape with the inlet and axis at the center and the discharge at the two ends. This runner is capable of passing anything that can find entry into the suction line and when installed in the case mentioned and driven by a 10-hp. 720-r.p.m. motor, proved entirely satisfactory. The pump has been in operation for over 18 months and has given no material trouble.

Particular care, in the design, was given to the study of properly cleaning pump and sump after use. The method of operation is simple. After emptying the sump the operator so manipulates the valves that screened sewage is pumped into it as flush water. The valves are again manipulated and the flush water is pumped from the sump back into the screen pit, ahead of the screen.

Based on experience at Long Beach, a well, permitting inspection of the underside of the screen without shutting down the plant, was provided. This well permits the operator to remove with steam or boiling water the grease which adheres to the underside of the slot and eventually clogs the opening in the screen. After the Santa Barbara plant was put in operation, the man in charge evolved the simple scheme of suspending a 5-gal. can over the brush trough and allowing kerosene to drip slowly on the brushes as they revolved. About one gallon of kerosene per day serves to keep the plates clean and the slots clear from adhering grease. This scheme has been found so practical, in fact, that it has been unnecessary to use the steam plant for cleaning purposes.

The screen is 10 ft. in diameter, is set on a 15-deg. slope, has ⅛ x 2-in. slots and in general conforms to the standards for this type of screen, which is the Riensch-Wurl. Its maximum capacity is 7 cu.ft. per second with a head loss of 18 in.



ARRANGEMENT OF SCREEN AND SCREENING PUMP AT SANTA BARBARA

An interesting feature of the plant is the method of disposing of the screenings. Originally it was intended to haul them in tank wagons to neighboring orange groves, there to be used as humus and fertilizer.

At the suggestion of Robert Craig, city manager of Santa Barbara, it was determined to try composting the screenings with street sweepings on the lot in which the screen plant is located. This lot is somewhat below the level of the plant proper and the adjoining roadways. The experiment was so successful that it has been continued as a permanent means of disposal. The procedure is exceedingly simple and the result is absolutely free from nuisance. The street sweepings, which

average from 3 to 5 dump-wagon loads per day, are used to build up dikes, marking off a series of basins approximately 20 ft. wide and 60 ft. long. Each night after dark the attendant starts the pump and delivers the screenings to the particular basin he is filling, through a 6-in. galvanized-metal pipe line such as is used for irrigating alfalfa. This pipe line is brought out each night and suspended from the discharge spout of the pump which projects through the pump-house wall well up toward the eaves. From this elevation the screenings flow by gravity to any part of the lot. The solids handled average about 5 cu.yd. daily, and are covered with enough dry sweepings to absorb most of the moisture and prevent the breeding of flies and mosquitoes.

This method of disposal has been continued for over a year and the beds first composted are being dug up for use on land in the parks. During the year the lot has been raised about 3 ft. over an area of approximately 20,000 sq.ft. No odor is apparent even when standing on the beds, the attendant reports no breeding of flies or mosquitoes and everyone who has visited the plant remarks about its neat appearance, cleanliness and freedom from offense.

A. B. Cook was city engineer when the plant was installed. Olmstead & Gillelen of Los Angeles acted as consulting engineers in charge of design.

Effect of Colorings on Concrete Strength Determined by Test

Discussing the paper on "Coloring Concrete" by John W. Lowell, before the recent annual meeting of the American Concrete Institute, Prof. Duff A. Abrams, of Lewis Institute, Chicago gave the following report of some tests on the effect of these coloring agents on the strength of concrete.

The accompanying table gives the averages of the compressive strengths of 3 x 6-in. cylinders, made of 1:2 mortar and tested at ages of 7 and 28 days. Portland cement was used; the aggregate was a coarse sand from Elgin, Ill. The percentages of coloring materials are in terms of the weight of the cement. Each value is the average of three tests made from a single batch of concrete. The tests on each color were made at different times; this accounts for the three values given in the third column for the mortars without coloring.

Coloring Material	Age at Test Days	Compressive Strength of Mortar Mixed with Different Percentages of Color, Lb. per Sq.In.					
		None	0.5	2	5	10	15
French's C.U. Blue	7	2,100	....	2,500	2,960	3,210	3,720
French's C.U. Blue	28	3,390	....	3,990	3,990	4,630	4,900
J. M. Wells Co. No. 2 Red	7	2,790	....	2,750	2,590	2,450	2,270
J. M. Wells Co. No. 2 Red	28	4,900	....	4,780	4,390	4,410	4,090
Cabot's Carbon Black	7	2,840	1,820	1,610	870	690	....
Cabot's Carbon Black	28	5,080	4,240	3,070	2,000	940	....

It will be seen that three different effects were produced: The blue appears to possess some hydraulic properties which caused it to show a steady increase in strength up to the highest percentage used (15 per cent of the weight of cement) at both 7 and 28 days. The red color caused a slight reduction in strength which is practically the same as the effect produced by other inert powdered materials in concrete. The carbon black produced a very great reduction in strength; 2 per cent of carbon black, reduced the concrete strength about 40 per cent. Bancroft in "Applied Colloidal Chemistry" 1921, states that "with a substance like carbon black which absorbs gas very markedly, as little as 5 per cent of the apparent volume may be due to the carbon black and a liter of carbon black may contain 2.5 liters of air." This peculiar property, no doubt, accounts for the effect on concrete shown by the tests.

Wing Walls of Concrete Arch Kept From Slipping by Tie Rods

By A. A. Blaeser
Allentown, Pennsylvania

In reinforcing the wing walls of a concrete bridge that had cracked loose and were pushing apart because of pressure exerted by a heavy fill, the method herein described was developed to save the expensive construction of new wing walls, to economize on excavation, and to keep the roadway in continuous use. The bridge is the coke works bridge of the Bethlehem plant of the Bethlehem Steel Co.

The bridge, 62 ft. out to out of walls, is crossed by double railway tracks and a switch, the point of which

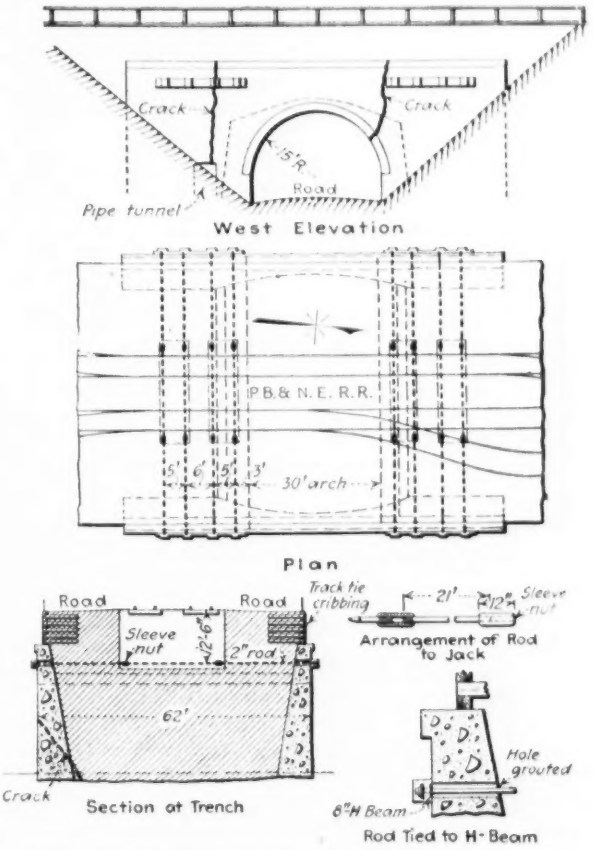


FIG. 1. ELEVATION, PLAN, AND SECTION OF BRIDGE SHOWING REINFORCEMENT, AND REINFORCING DETAILS

is in the center of the arch. The reinforcement of the wing walls was effected through the excavation of trenches underneath these tracks and the jacking of rods through the remainder of the fill and through holes in the wing walls which had previously been drilled.

The rods were put through on 5-ft. centers on either side of the arch parallel to the roadway. The trenches were dug 6 ft. wide and 23 ft. long. They were dug deep enough so that the rods could be jacked into place at an elevation of 12½ ft. below the surface of the roadway. This did not represent the distance of the tie rods below the top of the wing wall coping as the road surface had been built up considerably by the addition of timber cribbing which retained an additional fill.

The bolts were jacked from these trenches to either side of the wing walls and out through 7½-in. diameter holes drilled in the concrete wall which is from 3½ to 3 ft. 9 in. thick. When these bolts were put through they were connected at the center to a third section with sleeve nuts. It took an average of one day to jack and force each bolt through the holes as we sometimes missed the holes and had to rejack on account of the character of the fill, which was composed of refuse

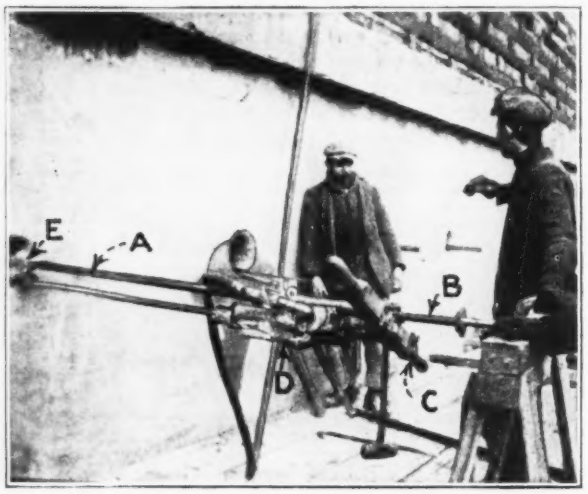


FIG. 2. AIR DRILL MOUNTED FOR HORIZONTAL BORING

from the plant, brickbats, ashes, salamander scrap, clay with large pieces of limestone, etc. Two rods were put in each trench, which was then back filled, and work started on the trench for the next pair. After the rods were jacked through the holes in the wing walls the work was completed by tying the four bolts in each set with an 8-in. H-beam and by grouting the cracks in the wall with a cement gun. The surface of the road over the arch was then spread with Tarvia to keep the water out, as freezing no doubt aggravated the trouble.

The drill rigging consisted of a drill mounted on a 1-in. pipe *A* (Fig. 2) by a band of sheet iron *B* with the handle bolted fast to the wooden handle *C*.

The handle *C* in turn was clamped to the pipe *A*. Near the forward end of the pipe *A* was clamped a guide *E*, this turning with the machine. The pipe *A* slid freely on a 1-in. rod *B*, which was long enough to reach into the core hole previously bored and back onto a horse. The cutting edge of the drill bar was about 10 in. ahead of the forward guide *E*. The drill was ground round when it rode in the guide *E* to save the strain on the ratchet.

The drilling operation was as follows: Before mounting the drill, a core hole was drilled through the wall, using a long drill bar and controlling its line and level by resting it on a guide frame. The drill was then clamped to the pipe and one man turned it continually several turns to the right and then to the left, while the other man with a handle pushed against the iron washer resting against the back end of the pipe and forced the drill ahead. We ran frequently 10 in. per hour, but averaged about 6 in. through a hard limestone concrete which at places contained some trap rock. The drill cut an annular space. In some cases we took out a 6-in. core, though generally, due to the smallness of the hole, the core crumbled.

Motor Vehicle Law Enforcement

Following the publication of the article "How Maryland Enforces its Motor Vehicle Law," in the issue of April 21, p. 666, letters were sent to several state highway engineers requesting comment. Their replies follow.—EDITOR.

BY CHARLES J. BENNETT
State Highway Commissioner, Hartford, Conn.

The motor vehicle department of Connecticut, which is not an adjunct of the state highway department, is doing excellent work by the use of loadometer jacks and also by the use of permanent platform scales. We are, however, not optimistic enough to say that we are preventing all the cases of overloading and our difficulty arises from the pirate truck that enters the State from outside with a very definite intention of violating the State law covering the loading of trucks.

Our highest limit is 25,000 lb. on four wheels, with restrictions to lesser amounts at certain seasons of the year. We can reach our own truck men and force them to live up to the law, but our greatest difficulty is with the out-of-state operator. We have installed checking stations at the State line in an endeavor to hold these trucks to a reasonable loading and are making headway against the difficulty.

There is in many cases an utter lack of principle in the operation of heavy trucks. The owner or operator fails to realize that in damaging the highway by the use of abnormally loaded vehicles he is hurting himself perhaps only a small amount, but is doing an infinite amount of damage to the property belonging to the general public.

The enforcing of the law is, of course, unpopular. While it is evidently a great benefit to the public investment, there is no agency which is particularly interested in aiding the department endeavoring to do this work, but we do have open opposition from the truck men when we try to put the truck in its proper place.

BY T. J. WASSER
State Highway Engineer, Trenton, N. J.

The system of motor vehicle law enforcement in New Jersey is not unlike that in Maryland, save that we are functioning with five scales instead of two, and that all the weighing is done at these scales rather than by loadometers or jacks. The weighing is in charge of the chief inspector of motor vehicles, to whom are assigned eight inspectors who traverse the roads and bring the heavy haulage vehicles to the nearest scales. Thereupon, if the vehicles are found to be overloaded a summons is served upon the operator who is required to appear before the commissioner of motor vehicles, sitting as a magistrate.

In addition to a minimum penalty of $100 for the first offense, or a maximum penalty of $250, and double the penalty for any subsequent offense, if the load is excessive it is removed from the vehicle and placed along the highway at the owner's risk. The scales which we are using were placed at the disposal of the motor vehicle department by the state highway commission, which appreciated the necessity of removing from the highways overloaded vehicles and those inadequately equipped with rubber tires, etc.

The New Jersey Highway Commission is expending

a considerable sum of money in locating these scales at advantageous points along the main arteries of the state highway system. Every scale has a weighing capacity of 40,000 lb., and is of the modern type, discharging a weight ticket immediately the weight of the load is determined. The state highway department, and the department of motor vehicles, work in close co-operation with each other in the apprehending of violators of the overloading clause.

By Clifford Older
Chief Highway Engineer, Department of Public Works, Springfield, Ill.

There has been on the statute books of Illinois for two years a law providing for the regulation of vehicle loads, but owing to a carelessly worded paragraph in this law it has been impossible to enforce it.

Part of the difficulty heretofore has been due to the fact that the State has no police force, nor have the officials of the division of highways any authority in carrying out the law other than that possessed by private citizens. County police officials have had no particular interest in the matter, inasmuch as the maintenance in connection with all improved trunk line roads falls upon the State. It is believed that means for the enforcement of the load limit law will be provided by the present session of the Illinois Legislature.

By J. C. Finch
Acting Secretary, State Highway Commission, Albany, N. Y.

We have read the article on the enforcement of motor vehicle laws in Maryland with a great deal of interest, particularly as it deals with a subject which is of vast importance in the State of New York at the present time. We are very favorably impressed with the means adopted in Maryland for the protection of its highways with regard to limiting the weight and speed of trucks and intend to incorporate some, if not all, of these features in a recommendation to be made to the Legislature for enactment into law next year.

The New York State Highway Commission is severely handicapped at the present time because of the fact that our authority to regulate the weight and speed of trucks is somewhat limited. Our present law prohibits the operation on public highways outside of cities of an auto truck or trailer having a width of body of more than 8 ft., a height of more than 12 ft. 6 in. and a gross weight of truck or trailer and load of more than 25,000 lb., the load to be so distributed that there shall not be more than 800 lb. per inch in width of tire on any one wheel, but no distinction is made in our law between rubber and metal tires.

The highway commission at the present time finds it difficult to enforce the provisions of this law because of the fact that the law places the enforcement primarily in the local authorities. The commissioner is given broad powers in the highway law to adopt rules for the protection of highways, but the difficulty we encounter is that the commissioner must act usually through local officials.

During last season we sent out a truck equipped with loadometers which patrolled the main thoroughfares of the State and stopped and weighed a number of trucks which appeared to be overloaded, but the system did not work to the entire satisfaction of the department, because it was difficult to secure conviction, owing to certain technicalities in our law which it is not necessary to go into in this communication. We intend to continue the weighing of trucks during the coming season and will do the best we can under our handicap in the law as it is at present.

I wish to thank you for sending us this article from the *Engineering News-Record* and to assure you that it will be of considerable value and assistance to us in the recommendation which we propose to make to the next legislature for a protective law with teeth in it.

By M. W. Watson
State Highway Engineer, Topeka, Kansas

The laws of Kansas do not grant to the highway commission authority to enforce the auto license law. Our traffic regulations are very lax, and even were we vested with authority there is very little to enforce at the present time.

By I. W. Patterson
Chief Engineer, State Board of Public Roads, Providence, R. I.

I was very much interested in the article, "How Maryland Enforces Its Motor Vehicle Law," especially in view of the fact that we are endeavoring at present to secure the passage by our General Assembly of legislation limiting weights, dimensions and speeds of all vehicles which may operate upon public highways. In Rhode Island it is not a case of discussing enforcement measures, but of considering the need for legislation. As far as our law is concerned, anyone in this State may operate any sort of a vehicle with any sort of tires upon any public road. Since 1916 we have been trying to secure the passage of legislation to protect our roads from abuse by excessively loaded vehicles and by excessive tire pressures. Our attempts so far have been without success, but we are optimistic concerning the prospects of the passage of an act before our General Assembly now.

Highway Transport Needs

Every state highway department should have a highway transport division to conduct economic surveys of projected new highways, according to Prof. Arthur H. Blanchard, University of Michigan, in a paper presented at a conference on highway transport education held in Ann Arbor, Mich., Feb. 23. In determining the location of a highway, said Prof. Blanchard, it is desirable to look ahead 25 to 50 years. In the case of a certain highway traffic increased 1,000 per cent in seven years (1913 to 1920). Possible future industrial developments along the route of the highway should be given consideration. It has been found to be neither economical nor safe to build highways with a single-track paved surface and earth shoulders. The paved surface should have a minimum width of 20 ft. since a vehicle width of 8 ft. is now permitted. In many cases, of course, it will be necessary to provide for at least four lines of traffic. Prof. Blanchard cited the case of the state highway engineer of Wisconsin, who recently resigned because he was not permitted to pay adequate salaries to his subordinates, as typical of conditions which must be corrected to insure the success of the highway program. He estimated that in order to carry on the projected new highway work for the next five years there should be trained by the colleges a total of 1,500 highway engineers and 4,000 traffic men per year.

The Case Against Engineering Practice by Corporations

Prominent New York Engineers Urge Governor to Veto Bill Amending Existing License Law—Ask for New Hearing

AS NOTED in the news columns of last week's issue, p. 696, forty-nine prominent New York engineers on April 14 addressed to Governor Miller a communication requesting his veto of the bill now before him for action (Senate No. 147,716), which would specifically permit the practice of engineering by corporations and unrestricted partnerships. Most of the text of the main body of the communication follows:

We, the undersigned members of the engineering profession practising in this State, respectfully ask that you veto the bill now before you entitled, "An act to amend the general business law, in relation to the licensing of professional engineers and land surveyors, generally," heretofore known as Senate Bill 147,716.

It may, perhaps, be helpful briefly to state that originally a bill, known as Senate Bill 147, was prepared with a view to effecting several amendments to the existing law, among which were a definition of professional engineering, not provided in the present act, and the elimination of section 39-k which permits non-engineers, under the guise of corporations and unrestricted partnerships, to engage in the practice of professional engineering. Later, the bill which is now before you, formerly Senate Bill 147,716, was introduced, in which were incorporated many of the amendments contained in the first bill, but in two respects radically differing from it, in that the definition of professional engineering is rephrased in a manner which we believe to be objectionable, and the right of corporations and unrestricted partnerships to practice engineering is reaffirmed in language even stronger than in the existing act.

It will be seen that the issues are clearly defined. A very large proportion of the leading engineers resident in this State, whose practice is purely professional, and representatives of the American Institute of Consulting Engineers, the American Association of Engineers, and of the New York Section of the American Society of Civil Engineers, believing that the interests of the public and of the profession are not served in the bill before you, voiced their reasons in a petition to the Senate Judiciary Committee dated March 9, 1921, and those who are in favor of the bill spoke in their petition dated March 21, 1921, addressed to the members of the Legislature.

While the proponents of the bill before you have had ample opportunity to consider and reply to their opponents' petition of March 9, in time to reach the Legislature, it was not until March 24, 1921, that we were placed in possession of the petition of the proponents, too late to prepare and deliver an effective answer before senatorial action was taken.

Hence we beg to bring to your attention the seven points contained in the above-mentioned petition of the opponents to the bill, the essence of the replies made thereto by the proponents and our comments on the latter.

Discrimination Nullifies Intent of Law

First, the opponents of the bill allege that the intent of the law nullified in permitting groups of non-engineers—bankers or what-not—under the guise of corporations, unrestricted partnerships and joint stock associations, indirectly to do those very things which the individual non-engineer is prohibited from doing; and, it may be added, to do those things which the qualified engineers may only do after he has had his technical and moral qualifications subjected to a searching examination and after he has paid the prescribed fee.

The proponents of the bill fail to reply to this charge of discrimination, which would seem to have sufficient weight to warrant a veto of the bill on this point alone.

Second, the opponents consider that the bill sanctions a practice that easily may be made an immoral one, in permitting an aggregation of individuals, in whole or part non-engineers, to serve in the dual capacity of supposedly disinterested professional advisers to a client and at the same time as self-interested financiers, sellers or contractors in the execution and supervision of the work in connection with which such professional advice is given, such sanction being diametrically opposed to the universally recognized rule that the engineer shall not be personally interested, directly or indirectly, in a company with which he has relations on behalf of his employer or client.

The proponents say that is is impossible to discover any serving in a dual capacity, in the simultaneous performance of "the functions of design and of construction or in performing the function of design for one client and of construction for another * * *". They have missed the point. What is viewed by us with alarm is the sanctioning of a condition under which an engineering corporation may have bankers, manufacturers and contractors on its board who may so dominate its policy as to influence its management, including its engineering employees, in the preparaton of reports, plans, contracts and specifications and in the supervision of work, in such manner as to favor the outside interests of such directors to the injury of the client (the public). This is no idle fear. In the case of common carriers this practice of interlocking directorates is forbidden by law.

Loss of Professional Responsibility

Third, the opponents feel that the professional engineer in the employ of an engineering corporation or unrestricted partnership, made up in whole or part of non-engineers, is relegated to a position of anonymity or that of the servant, relieving him of all professional responsibility to the client and placing him under the direction of those whose primary interest is a banker's or contractor's profit.

The proponents mistake this point to mean that were it to have weight, even the independent engineer could not employ assistants, which, of course, is not the case. The professional engineer who signs a report or an engineering plan or specification is personally responsible. The engineer who works for an engineering corporation controlled by bankers or contractors is responsible only to the corporation upon which no equivalent responsibility is imposed by the State.

Violation of Codes of Ethics

Fourth, the opponents assert that conditions are permitted under which a group, constituted in whole or in part of non-engineers, with impunity may violate the codes of ethics which have been adopted by various professional societies for the guidance of their members and for the protection of the public.

The proponents of the bill do not reply to this, and it is therefore to be inferred that it is unanswerable. Corporations are free blatantly to advertise and to solicit patronage, while independent engineers are restrained from doing so either by good taste or by professional ethics. In fact there are well known instances of practices by engineering corporations and unrestricted partnerships which are in direct violation of the professional ethics to which some of their officers or members in their individual capacities have subscribed. This is unfair to the independent engineer and destructive of that high respect for the profession which is of public concern.

Inferiority Compared With Other States

Fifth, the opponents call attention to the fact that the holder of a license issued by this state is placed on a plane inferior to that existing in seven of the ten other states of

the Union in which licenses to practice the profession are now required, and on a plane inferior to that existing in Canada.

The proponents of the bill avoid touching on this feature and, consequently, may be assumed to find it unanswerable. It places licenses in this state at a distinct disadvantage when applying for the right to practice elsewhere. As time goes on and more states adhere to the view which we advocate, the status of the engineers of New York will become increasingly unenviable, unless we set our face against the practice of engineering by corporations and unrestricted partnerships, made up in whole or in part of non-engineers.

Lowering Dignity of Profession

Sixth, the opponents state that the dignity and standing of the profession of engineerng is lowered by legalizing that which, in the Penal Law and other laws of the State, is stamped as illegal in the cases of law, medicine, dentistry, veterinary surgery and nursing.

The proponents admit that this point of view "would to a certain extent apply" if engineering resembled the other professions named; but they say that while law deals with rights and medicine with life, engineering has to do with materials and occupies a field to a high degree less personal than the fields of law and medicine and, inferentially, less than the fields of dentistry, nursing and veterinary surgery. If this were true it should be frankly admitted that engineering is a trade devoted solely to money getting, and not a profession in the true meaning of the term, animated by an impartial spirit of service in "instructing, guiding and advising others."

It may be safely assumed that engineers generally will not accept this low valuation placed upon them by the proponents and will not submit to the charge that they are "the servants of economics or business, submitted invariably to the test and the involvements of commercial costs." The engineer, in directing the force of nature for the use and benefit of man, is a leader in the highest sense and a trustee of the savings entrusted to him by his client, the public. He must be as faithful to the principles of justice and as observant of the sacredness of human life as members of the other professions. In fact, the very purpose of the license law is to serve these ends.

If it is true, as asserted by the proponents, that "the ethics of engineering revolve about a different axis from the ethics of law and medicine," it is high time that engineers took a stand against the practice of their profession by corporations which have such a low conception of its obligations.

Detrimental to Public Interest

Seventh, the opponents consider that the bill is detrimental to public welfare in that it tends to force engineers in independent practice to abandon their purely professional work and affiliate with contracting or banking organizations, thus depriving the public of the disinterested and effective service of the men who hitherto have been chiefly responsible for the progress of the engineering art.

The proponents' reply to this is to the effect that it is desirable and necessary, in the public interest, that the engineer who is identified with the creating of large and complicated projects shall associate himself with moneyed and business groups, in order that he may have greater pecuniary and legal responsibility, especially in connection with cost-plus (assured profit) contracts for which a special plea is made, and in order that he may be better fitted for commanding a force of specialists.

From a policy of this kind, with no inhibition on interlocking directorates, as in the case of common carriers, organizations are to be expected in which the engineer shares with his non-engineer associates in the distribution of his purely professional fee, and in addition shares in the bankers', manufacturers' or contractors' profits flowing from the execution of the work which he initiates, investigates, plans and directs.

It would seem that merely to state this proposition is to condemn it as utterly opposed to public interest. No man can even-handedly serve two or more masters; neither is wealth a necessary possession of the professional man in giving efficient and honorable service to his fellows, no matter how large or complicated may be the problem.

The proponents of the bill themselves have raised several points which require answers:

It is stated that the elimination from the license law of the clause that permits corporations and unrestricted partnerships to practice engineering would put existing concerns of that nature into the hands of receivers. It is, of course, understood that partnerships embracing engineers only will in no manner be affected any more than they are so affected in the other states of the Union where there is no special reference to this matter in their license laws. Several engineers united in a partnership from which non-engineers are excluded naturally have the right to refer to themselves in the plural sense if they are properly licensed. It is the unrestricted partnerships embracing non-engineers as well as engineers that, in company with engineering corporations and joint stock associations, would have to effect changes on or before May 1922. This would not necessarily mean receiverships. Where there is a will there is a way to bring about the separation of professional and business functions without financial hardship.

The opponents of the bill have no desire to prevent any proper professional practice by engineers eligible to license under the existing law. On the contrary they seek not only to protect the public and the profession by definitely fixing responsibility, but also to secure for all professional engineers a just recognition and prevent the exploitation of the profession by banking or commercial interests.

Changes in "Model Bill"

The proponents affirm that the position taken by the opponents is contrary to the provisions of the model bill (so-called) of Engineering Council and the impression is given that in so doing the opponents of the bill are running counter to the engineering sentiment of the country.

That the so-called model bill in all particulars is not to be considered as sacrosanct is prove by the proponents' own many departures from its provisions; by dissimilarities in the drafting of license bills in the other states; and by the action of the American Institute of Consulting Engineers, the New York Chapter of the American Society of Civil Engineers and the New York Chapter and State Assembly of the American Association of Engineers, in voicing their protest against the provision that sanctions the practicing of engineering by non-engineers.

It should be realized that the so-called model bill is the product of a few minds, acting in committee, and that it has not been considered in detail and passed upon by the society memberships. The engineering societies above named, we believe, are the only ones which have taken action since the issue of Senate Bill 147,716 was raised in this state. If this bill be now vetoed and time thus afforded for investigation and action by other national and state engineering societies we regard it as practically certain that a great majority of the membership of every professional engineering society will be found in opposition to the bill.

Conclusion

Shall we see the creative work of the engineer pass from his control to that of "the exploiter, the speculator, and service become the handmaiden of profit," and shall we see the door of opportunity narrowed or closed to the young engineer who looks forward to the independent practice of his profession? May we express the hope that you will answer these queries in the negative by vetoing the bill and thereby leave the existing law unchanged. Then the engineering profession will have before it an unprejudged clean-cut issue on which to go to its membership, with a view to offering suitable amendments at the next session of the Legislature.

May we ask that you kindly give us a hearing at such time as you may fix so that first-handed you may see who we are, and so that we may orally supplement what we have here said with such additional data or arguments as may be required for the clarification of a matter that means so much to our profession and to the public.

State Highway Department Notes

Readers of this column are urged to send us news regarding the work which their State Highway Departments are doing. Information is particularly desired on such subjects as administrative policy, legislation, contracts, changes in design or specifications, research work, traffic studies, motor vehicle control and construction and maintenance.—Editor.

New Jersey—As part of its program for the study of subgrade failures, drainage and strength of concrete the state highway commission has ordered a large core drill for the purpose of securing samples of existing pavements which have been in service for varying periods.

Connecticut—To aid in the enforcement of the motor vehicle law large illuminated sign-boards informing drivers of the more important state regulations governing automobiles and trucks have been erected along some of the state highways, as shown in the accompanying photo. The signs are 50 ft. long and 15 ft. high. An inspector of the motor vehicle department is stationed at each sign and scrutinizes every car as it passes. If a vehicle appears to be violating the Connecticut law it is stopped and the driver is required to correct the forbidden conditions if possible or else is refused admittance to the state and is forced to turn back.

STATE OF CONNECTICUT
DEPARTMENT OF MOTOR VEHICLES AND STATE HIGHWAY COMMISSIONER
OFFICIAL WARNING!!
RECKLESS DRIVING ABSOLUTELY PROHIBITED. SPEED AT ALL TIMES MUST BE REASONABLE AND PROPER
TAIL LIGHTS MUST SHOW RED WHITE TAIL LIGHTS PROHIBITED.
ALL ACCIDENTS MUST BE REPORTED
METAL TIRED WHEELS ON MOTOR VEHICLES PROHIBITED.
VEHICLES APPROACHING FROM THE RIGHT AT INTERSECTING STREET HAVE RIGHT OF WAY.
VEHICLES MUST NOT STOP ON CURVES OR HIGHWAY
PROPER LIGHTS REQUIRED ON ALL VEHICLES.
ALL COMMERCIAL MOTOR VEHICLES MUST HAVE A MIRROR PROPERLY ADJUSTED.
VEHICLES PROHIBITED STOPPING ABREAST OF EACH OTHER ON HIGHWAY.
ARRESTS WILL BE MADE FOR VIOLATIONS OF THE ABOVE
For Information Address Commissioner of Motor Vehicles, State Capitol, Hartford

HOW CONNECTICUT INFORMS DRIVERS OF MAIN PROVISIONS OF STATE MOTOR VEHICLE LAW

At night the signs are illuminated by six 200-watt nitrogen lamps. At the present time, according to information received from Alden L. McMurtry, chief inspector of the State Department of Motor Vehicles, there are nine of these signs located on the most important highways leading into the state and it is intended to erect more as traffic over the smaller roads increases. On all routes entering the state, however, there are small signs calling attention to the more important motor vehicle regulations which must be observed. The policy of enforcement of the motor vehicle law in Connecticut is such that it is preferred not to make arrests unless conditions require that the violator be dealt with harshly. An effort is made to distinguish between violations due to negligence or ignorance of the law and those of a wilful nature.

California—Experiments in the preparation of subgrades on soils which have proved to be poor foundations for highways are to be conducted in California under an arrangement which has just been entered into between the California Highway Commission and the U. S. Bureau of Public Roads, which recently submitted an exhaustive report (see *Engineering News-Record*, March 17, p. 469, on California's highways. It has been discovered that the presence of colloidal matter, capable of extraordinary absorption and retention of water, in the clay and adobe soils of California has been responsible in large measure for subgrade troubles. Colloids have been extracted from these soils, and the result has been that the soil has been left inert and deprived of its quality of absorption. Experiments show that the colloids found in these soils are capable of absorbing and retaining water up to several hundred times the volume of the colloids.

According to a statement issued April 14 by A. B. Fletcher, chief engineer of the California Highway Commission, following his return from a conference at Washington, D. C., with Thomas H. McDonald, chief of the Bureau of Public Roads, the chief difficulty that highway engineers have found in building roads over these soils has been due to the large expansion and later contraction of the subgrade, resulting in longitudinal and other cracks in the surface slab. The attempt heretofore has been to overcome this by increasing the thickness of the surface slab.

The effort now is to be made to overcome this tendency to large expansion and contraction by neutralizing the colloidal properties of the soil and rendering the subgrade a suitable base upon which to build the concrete slab. Discussing this phase of the matter, Mr. McDonald, in a letter to the California Highway Com-

mission, has outlined the policy of the Bureau of Public Roads relative to approval for federal-aid allotments as follows:

The report of the California study made by this bureau is in your hands and you will note that the accent is all placed upon the kind of subgrade under the roads, and this we hold to be the most important consideration in the building of future highways in your state. It is the hope of this bureau in co-operation with the state highway department to carry on certain experimental and research studies in the preparation of the subgrades over those soils which have proven to be poor foundations. We believe that such studies will point the way to the construction which will prove to be adequate. There should be no contention as to minor differences in the details of design for surface construction. Minor changes in the specifications for road surfacing will not insure their future integrity. We feel that the big problem is to stabilize conditions under the surface and this is the line of research that we feel can be most profitably carried out between your department and the bureau and that these studies and experimental construction should proceed at once.

In connection with the statement of the experiments to be conducted in treating adverse subgrade soils announcement has also been made by the Bureau of Public Roads that a regional office is to be established in San Francisco, having jurisdiction over eleven states and which will exercise a large degree of authority. This office will probably be in charge of Dr. L. I. Hewes, who conducted the study of California highways for the U. S. Bureau.

North Carolina—A motor equipment field for the storage and repair of surplus war material in the form of motor trucks, tractors, concrete mixers, derricks, etc., received from the U. S. Army for state highway construction, is being built on a 3.84-acre lot 2½ miles west of Raleigh. The project consists of a 50 x 118-ft. machine shop, a 50 x 150-ft. storage warehouse, and truck sheds 50 ft. wide with an aggregate length of 1,150 ft. The truck sheds are of steel construction with galvanized corrugated metal roofing and siding. Most of the trucks received from the War Department have been rented for a nominal sum to the various counties and to contractors working on federal-aid projects; others are being used by the highway commission on work done by force account. The new motor equipment field will cost about $60,000. State convicts are performing most of the labor.

New Hampshire—Acting on the authority granted March 17 by an amendment to the state road laws, F. E. Everett, State Highway Commissioner, issued a notice, effective March 21, prohibiting vehicles of more than 3 tons gross weight from using the trunk line, cross-state, and state-aid highways. The purpose of the order, it was explained, is to protect highways during the spring thaw and will be withdrawn as soon as conditions permit.

Louisiana—A proposal to levy a tax of 2c. a gallon on gasoline used in motor vehicles operating over state highways is under consideration by the State Constitutional Convention at Baton Rouge.

Kansas—The 1921 Legislature rejected the idea of state-aid and adopted the county unit plan whereby automobile license funds are to revert to the counties in which collected for use at the discretion of the county commissioners.

Pennsylvania—Road contractors in Pennsylvania were notified to begin construction in orders issued March 31 by Colonel W. D. Uhler, chief engineer. The advanced season gave contractors a two weeks' start over 1920.

Bascule Bridge Repaired by Electric Welding

LAST year repairs were made in the operating machinery and structural parts of the South Michigan Ave. bascule bridge over the city ship canal in Buffalo (Fig. 1), in simple and effective manner by electric welding. The bridge is of the Scherzer type, of 110-ft. span, built in 1905, and has been operating continuously since that date. Wear and final seating of both the horizontal and circular operating track plates allowed the bridge parts to settle to such an extent as to cause the teeth of the rack and pinion on each side of the bridge to seat hard, reducing the clearance between tooth and tooth to nothing. This brought

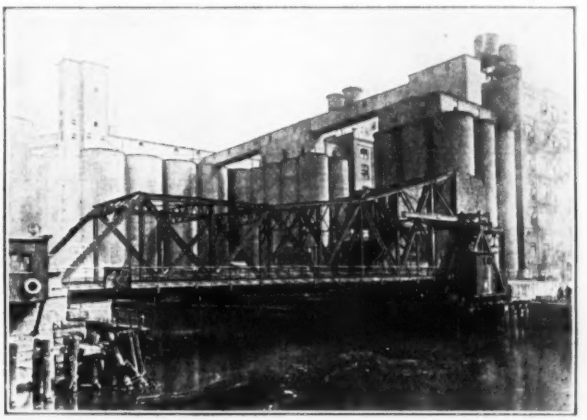


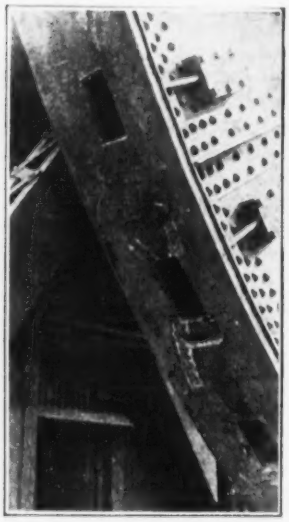
FIG. 1. SOUTH MICHIGAN AVE. BASCULE, BUFFALO

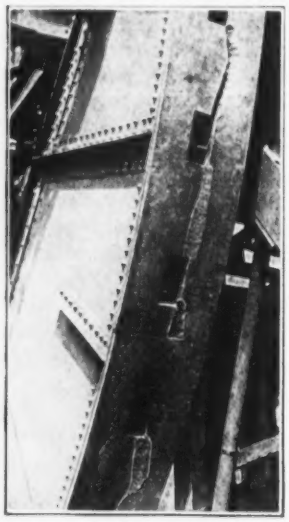
undue strains upon the bearings of the operating machinery and upon the structural members carrying the machinery, especially when pinion bearing and rack bearing were directly over each other, and ultimately broke the backs of the girders carrying the main bearings of the machinery. The bridge was thrown out of alignment and the metal of the circular 2 x 21-in. track plates fouled the lugs on the horizontal plates, cracking and breaking out the metal between the lug holes.

Repairs had to be made. The question was what was the best method of procedure. At first it was thought best to renew the 2 x 21-in. plates, but owing to the difficulty in having them made, the delays, the high costs, and the fact that the present plates have found their proper bearing, this idea was given up, and arrangements were made with the Marine Welding Co. of Buffalo to electric-weld the broken places between lug holes in the arc plates.

The usual method of electric welding was employed, namely, burning out a V-shaped trough, using the pieces broken out and building up with new metal. From the views (Figs. 2 and 3), the nature and extent of this work is clearly shown, and has proven satisfactory in every way. The job was done in three weeks' less time than would have been required for renewal, and without disturbing the bearing plates.

In connection with this work it was found that the angles to which the arc plates were bolted were cracked in the throat, in some places one-third of their length, in others two-thirds the distance between vertical angle stiffeners. These breaks were entirely through the angles, and were probably caused by the extra load brought to bear on the angles by the breaking out of the metal of the track plates between lug holes. The





FIGS. 2 AND 3. ELECTRIC WELDING OF TRACK PLATES

breaks in the angles were welded without disturbing the bolts or nuts.

As a further feature of the work, illustrating the applicability of the welding process, a broken tooth in the steel pinion between engine and main operating shaft was pinned by three pins to the pinion body and then electric-welded. The job was satisfactory in every way.

Under the main bearings of the operating machinery two new girders were put in to replace the two broken ones, and the bottom of the main bearings were planed off ⅜ in. to give proper clearance between teeth in racks and pinions.

The bridge as repaired has been in service since February, 1920. In summary, a cheaper, quicker and more satisfactory job resulted than could have been obtained by disturbing the old properly seated parts. The work was done under the direction of George H. Norton, city engineer of Buffalo, and Frank D. Jackson, assistant engineer of the bridge, river and harbor department.

Tamped-in Wearing Course for Concrete Roads in Iowa

Besides the usual one-course concrete pavement a full depth slab "with a wearing course of abrasion-resisting stone forced into the surface of the concrete and made a part thereof" is provided in the 1921 specifications of the Iowa State Highway Commission. A coarse aggregate—100 per cent passing a 2½-in. screen and 90 per cent retained on a 1-in. screen—is required. Crushed trap, quartzite or granite, or clean pebbles, are specified, with not more than 15 per cent of sandstone, limestone or other similarly soft rock and not more than 2½ per cent of disintegrated particles, and with no sound stone having a French coefficient of wear less than eight. After the concrete slab is struck off to profile in the usual way a layer of surfacing stone is spread evenly and closely on top. This stone, it is specified, "shall be forced into the surface of the concrete and made a part thereof and the whole mass thoroughly compacted by means of any mechanical device or appliance which will force out excess water and will leave the course of abrasion resisting stone embedded in mortar and parallel to the finished surface of the pavement."

Industrial Opportunity of Federated Engineering Societies

Profession Confronted with Ages-Old Problem of Division of Fruits of Labor, and in Very Complex Form

TAKING the position that the problem of the division of the fruits of industry is one of the most important confronting the engineer—and in fact is *the* problem which most differentiates the present task of the engineer from that of his predecessors—Dexter S. Kimball, dean of the College of Engineering of Cornell University, maintained in an address at the Philadelphia Engineers' Club dinner to Herbert Hoover, April 16, that some organization like the Federated American Engineering Societies was necessary to back up the engineers in this great work. Single societies aim to serve the individual. The federation, on the other hand, is dedicated to national service, and no greater service is possible, he believed, than the solution of the major problems of industrial management.

Dean Kimball spoke in part as follows:

Division of Labor

Industry is the life of our nation, and engineering is the backbone of industry. Surely if any class of men have a right, or better still a duty, to band themselves together for the betterment of the fundamental industrial principles of our nation, engineers, using the term in a broad sense, have full justification for so doing.

There is, however, a much greater and deeper reason why we have need for a society of this kind. We are all prone to think that the problems of our day and date are peculiar and unlike any that have gone before. As a matter of fact, history teaches us just the contrary. The great fundamental principal of all civilization is dvision of labor: at once the most effective tool that man has ever devised, it is at the same time the cause of his greatest difficulties. Because wherever division of labor is employed co-ordinated effort necessarily follows. We know of no civilizations built up by a single individual. But with co-ordinated effort comes always the difficult problem of awarding fairly and justly the fruits of labor, and from the beginning of time men have wrestled unsuccessfully with the problem of "What Is Mine and What Is Thine." The Mosaic code, based on a much more ancient Egyption code, the remarkable code of Hamurabi and a still more ancient code recently discovered, all bear witness that this problem is very ancient. The solutions offered by these ancient codes are for the most part of a legal character, often very arbitrary and intended more as a means of keeping the peace rather than as a solution of the problem on the ground of merit and justice. And to a large extent we have inherited these viewpoints in our modern industrial codes.

Wherein does modern industry differ from these ancient civilizations? The advent of the modern machine era and the extension of the use of scientific methods have carried division of labor to a degree undreamed of by our ancestors a few hundred years ago. If the ancient civilizations were complex ours is infinitely more so and the difficulty of defining "What Is Mine and What Is Thine" has increased many fold.

Out of this chaotic condition, however, three viewpoints today stand out above all others and are well worthy of careful consideration. The first is the conviction that is rapidly taking root in the minds of thinking men that industry should be considered a means of supporting the human race, and not as a means of personal, corporate or state profit; the conviction furthermore that all men are entitled to a certain amount of physical, mental and spiritual well-being, and that the nation which can develop such well-being is the one that will endure.

The second is a conviction that no adjustment of these difficult industrial matters can be enduring that is not

based upon justice. This conviction differs from the old legal viewpoint quite markedly, and it is well illustrated in our changed point of view concerning accident compensation. For hundreds of years accident compensation was based on legal verdicts inherited by us from old English common law and having sometimes little to do with justice. The modern compensation law is an effort to adjust these matters on the ground of justice and the fair deal.

The third conviction is that there can be no justice where there is no knowledge. Any one who has read carefully the history of industrial disputes during the last few years cannot fail to be impressed with the truth of this statement. Wherever a wide knowledge of fact can be obtained adjustments usually are not difficult, but an enduring adjustment can never be accomplished where facts are not known.

The Engineer's Function

What has this to do with the work of the engineer? A very great deal indeed. A few years ago the engineer was looked upon as one who built and designed machines or structures. With the growth of his technical and scientific background it has become necessary for him to assume the management of industry and today he stands as the foremost figure in industrial management. This has brought him for the first time in close touch with the human element of industry and face to face with the great problem of the distribution of wealth.

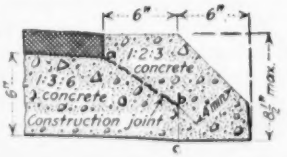
It should be remembered that the engineer in thus enlarging his field has brought with him the most powerful mental tool that the human race has devised, and which we call commonly the "scientific method." With this method he has conquered and subdued nature. At the present time is teaching the human race a better and more efficient means of organizing industry. It remains to be seen whether he can apply this method to the solution of the old-time problem of "What Is Mine and What Is Thine." It should be remembered that this problem has been wrestled with by many able minds, but it will also be remembered that many of those who have given much time and thought to the problems did not have the intimate knowledge of industry, and of those who work in industry, that is the possession of the engineer today. If he undertakes the solution of this problem with the same energy and vision that he has applied to fields that he has already conquered I am hopeful for the result.

I see, therefore, in the Federated American Engineering Societies something more than an organization to assist city, state and nation in the solution of technical problems. I see in it an opportunity for the engineer to study and to solve the last remaining problem of civilization. I see in it a means of gathering data on the industrial problem such as we have not possessed, and in a general of obtaining that knowledge which, as I have already indicated, is absolutely essential to the solution of this great problem.

Back of a movement as great as this we need an all-embracing society of engineers. The functions of such a society will differentiate sharply from those of an indivdiual society in that the individual society is more likely to deal with service to the individual. This society is organized for service to the nation. It is a challenge to national service.

Replacing Header Curbing

Where renewal of header curbing is necessary because of wear or poor alignment the method illustrated by the accompanying sketch is employed in Pennsylvania. The old concrete is broken away along the line *abc* so as to leave a rough surface. This surface is cleaned of loose particles, then is thoroughly wetted and finally is plastered with neat cement mortar before the new concrete is placed. Until the new curb is hard it is protected from traffic.



Engineering Standards Committee Reports on Year's Work

THREE standards were approved by the American Engineering Standards Committee in its first year, or to the end of 1920, and six others were submitted to the committee for approval but have not yet been acted upon. Work was started during the year on fourteen standards to be formulated under the direction of the committee, and on twenty-four safety codes. International co-operation on standardization has also been initiated in four or five subjects. These figures summarize the activities of the committee as outlined in the committee's first annual report, which has just been presented.

During its first year it experienced a very large growth, no less than nine bodies joining in addition to the eight which formed the original committee; the working committee is composed of 47 delegates representing the 17 members. The new members are the Fire Protection Group, the National Safety Council, the Electrical Manufacturers' Council, the National Electric Light Association, the Society of Automotive Engineers, the Gas Group, the American Electric Railway Association, the Department of Agriculture and the Department of the Interior. Although the committee's income increased with the growth of membership (the dues being $500 for each representative on the committee) yet the committee reports that "a substantial increase in revenue is necessary to support and develop the work," and that "it has been decided to seek contributions from industrial associations and companies interested in standardization."

Approved Standards—The standards already approved by the committee are those of the American Society for Testing Materials for portland cement and for fire tests of materials and construction, and those of the American Society of Mechanical Engineers and the American Gas Association for pipe threads. However, as the American Society for Testing Materials amended its portland cement specifications last year, the revised specifications have been submitted for approval to supersede those already approved.

Standards Submitted—The "National Electrical Code" of the National Fire Protection Association, and the Bureau of Standards' safety code for head and eye protection have been submitted for adoption as standards. Four standards of the American Society for Testing Materials are also up for approval, these being the revised cement specification, a test for toughness of rock, a method for sampling coal, and a method for distillation of bituminous materials suitable for road treatment.

Work in Progress—Standardization work now in progress under the jurisdiction of the committee is being carried on by a large number of organizations that have been named as sponsors of the respective subjects. The subjects include: Ball bearings, limit gages, gears, machine tools, nuts and bolt heads, pipe flanges and fittings, screw threads, shafting, colors for pipe lines, elevators, rating of electrical machinery, electric terminal markings, steel shapes, zinc ores and zinc. The twenty-four safety codes in process of formulation range over a wide field from aviation and foundries to ladders and industrial sanitation.

Several of the items of work just named were the outcome of discussion at conferences embracing all

interested parties, who met to consider the desirability of attempting standardization in the field in question. A conference of government departments and technical societies was held last August to consider whether aircraft standardization should be undertaken in conjunction with delegations from various foreign governments; the conference decided affirmatively. A similar conference on elevator standardization recommended that standardization should be sought on such fundamentals as traffic characteristics, material-handling conditions, factors of safety, capacities, platform sizes, and methods of test. Mining standardization was discussed in another conference, which recommended that a general correlating committee for mining standardization be organized to guide the organization of such work.

Work on screw threads and on the standardization of shapes for structural steel proceeded from suggestions received from abroad that a considerable degree of international unification might be attainable. The work on steel shapes is, in fact, on an international basis. There is also international co-operation with a Swiss standardizing body on ball bearings, nut and bolt heads, with a Belgian society on zinc, and with the British association on gages and machine tools.

A. A. Stevenson is chairman of the American Engineering Standards Committee, and Dr. P. G. Agnew is secretary, with offices in the Engineering Societies Building, New York City.

Comparison of Three Filters Near Chicago

FEW people realize the great difference in the character of the water of Lake Michigan north and south of Chicago. A comparison of the operation of three filter plants, Evanston, Whiting and East Chicago, given recently by S. A. Greeley, consulting engineer, Chicago, before the joint meeting of the Iowa and Illinois sections of the American Water-Works Association, indicates that the north plant had little pollution and only that of domestic origin to deal with. The southern plants were greatly handicapped by the intense industrial development in their vicinity, where 500 m. g. d. of industrially used water is poured into the lake, making the water an ideal medium for the development of filter clogging diatoms, and giving it a medicinal taste from quench waters and oil refinery discharges.

Both the Evanston and East Chicago plants started with the handicap of overload reduced eventually by meters. Relative detention periods of the three plants are 1⅛ hours for Evanston, 3¾ hours for the East Chicago and 4½ hours for Whiting. During the first, second, third and fourth months of operation at Evanston when the plant was started in 1914 the length of runs was 3.8, 5.3, 8.3 and 7.3 hours respectively. Runs of 7 to 8 hours continued to the spring of 1915, then gradually increased to several days' duration, as the rate of consumption has finally decreased from two-thirds capacity to one-half capacity. Alum application averages 0.7 gr. per gallon, seldom being increased to 0.9 gr. In January and February, 1921, the rates were 37 and 40 per cent of capacity, the runs 75 hours long and wash water 1.3 and 1.6 per cent.

At East Chicago, where the plant started last fall, the January capacity was exceeded by 25 per cent, making the runs 3.6 hours long and wash water 11.1 per cent, with 1.2 gr. of alum. In February an amount equal to the rated capacity was filtered. The runs were 6 hours long and the wash water dropped to 6 per cent, but to reduce the diatoms from 2,000 to 500 standard units 1.8 gr. of alum was required.

At Whiting an amount slightly less than the rated capacity of 4 m. g. d. was filtered, the runs being of 8 and 9.4 hours length, alum 1.5 and 1.4 gr. and lime 0.7 and 0.8 gr. per gallon for January and February respectively. One of the specific requirements of this plant was to remove by aërators the oily taste and odor. A distinct improvement is noted and there is a distinct odor emanating from the aërators.

Machine "Perforates" Timber To Facilitate Preservative Treatment

A MACHINE designed to perforate cross-ties and dimension timber before treatment by the creosoting process has recently been installed at the plant of the St. Helens Creosoting Co. at St. Helens, Ore. This machine is expected to bring the perforating process out of the laboratory and into the commercial field by doing on a wholesale scale that which has been done by hand in an experimental way for several years. The perforating process, according to the "Cross-Tie Bulletin," consists in puncturing all the exposed surfaces of the wood, except the ends, with saw-tooth holes made on lines running across the grain diagonally.

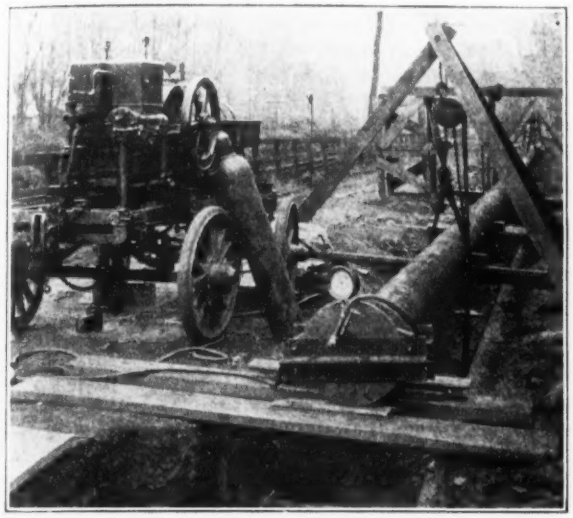
Fundamentally, the machine consists of four perforating rolls or drums mounted substantially and provided with driving mechanism. Two of the drums are horizontal and two vertical and all four have a diameter of 14½ in. The tooth spacing in the horizontal drums is 14 in. wide and in the vertical drums 8 in. wide. The axis of one horizontal and one vertical drum is fixed rigidly and both are driven by 10-hp. 440-volt a.c. motors, geared directly to the drums. The other two drums are adjustable for timbers of various sizes, the range being from 3 x 6 to 8 x 14-in. cross-sections. The adjustable drums also have flexible connections which permit of rocking or tilting as much as ½ in. to conform to variations in the shape of the timber. The adjustable drums are fitted with heavy coil springs.

Each drum contains twenty-five tooth-ways, arranged to carry the teeth for perforating on approximately 2-in. centers lengthwise of the timber. Teeth of tempered tool steel are placed in the tooth-ways with spacing blocks as required and project ¾ in. from the surface of the drums. The faces of the drums are kept in contact with the timbers passing between them, so the teeth penetrate into the wood for their full length. The speed of the machine is such that about 70 lin.ft. of timber is handled per minute.

Based on results secured with hand-perforated timber, the following advantages are claimed for preservative treatments applied after perforation: (1) Control, reduction or complete elimination of checking in green ties and timber if perforating is done promptly after cutting: (2) Reduction of the temperatures required to secure satisfactory impregnation. This will reduce the injury to the fiber. (3) Reduction of the time required to treat ties and timber in the retort. This will reduce the loss in mechanical strength. (4) A complete and uniform penetration of the preservatives to the depth of the perforation. (5) Reduction of not over 8 to 10 per cent in the strength of the timber.

Welded Joints on a Steel Gas Main

IN THE construction of an eight-mile gas main of 12- and 16-in. steel pipe near Philadelphia, Pa., the joints are welded by the oxyacetylene process. For the greater part of the work the welds were made above the trench, the pipe being turned for the convenience of the operator in making a weld all around the joint. This method was found to be more efficient and economical than welding the pipe either in or above the trench



WELDED GAS MAIN UNDER TEST

without turning it. If its cost is taken at unity the other methods would be 1.6 and 1.3 respectively.

The 20-ft. lengths of pipe, with beveled ends, were butted together and tack welded at four points to maintain the alignment, this being done without turning the pipe. As the welder worked at a joint, the pipe was turned by laborers with chain tongs. With the filler rod and pipe ends thoroughly fused, the V formed by the beveled ends was filled with metal to about $\frac{1}{8}$ in. above the surface of the pipe.

About fifteen lengths of pipe were welded and the 300-ft. section was then lowered into the trench. Leakage tests were made on sections 200 to 300 ft. long, both ends being closed by a steel plate fitted over a rubber gasket and secured by bolts through a ring clamp around the pipe, lugs being welded on the pipe as bearings for this clamp. A 30-lb. air pressure was then maintained in the pipe, while soap water was brushed over the joint in order to reveal leaks. Most of the sections were tight. Leaks were closed readily with the torch and could be traced usually to defective pipe or to the welders working without protection on windy days. Joints between the sections were welded in the trench, pockets being cut to enable the operator to work on the bottom of the pipe. An air test of the two combined sections was then made, the air pressure being left on all night to insure tightness of the joints.

This welding was done by the Air Reduction Sales Co., New York City. Joints made in this way are said to cost 25 to 50 per cent less than joints made with threaded pipe and couplings, and are said also to involve much less maintenance cost than the latter. The pipe line is to convey byproduct gas for the Counties Gas and Electric Co., which is a subsidiary of the United Gas Improvement Co., Philadelphia.

Hoover Outlines Principles of Government Reorganization

Each Department Must Have Single Purpose—Government Aid to Business Must Not Be Paternal

HERBERT HOOVER, Secretary of Commerce, explained his ideas regarding the reorganization of the government and the expansion of the functions of the Department of Commerce in an address at the dinner given in his honor by the engineers of the Philadelphia District, under the auspices of the Philadelphia Engineers' Club, April 16.

The main theses of the address were that "the administrative units of the government must be reorganized so as to give each of the great departments more nearly a single purpose," and that the work of the Department of Commerce must be so strengthened that "we shall concentrate and enlarge our national effort in the aid, protection, stimulation and perfection of our industrial and commercial life."

The address in part follows:

Reasons for Reorganization

There is one problem of the new administration that has received the attention and thought of the organized engineers of America for many years past. This is the problem of the reorganization of the federal government. The inadequacy, the wastefulness, and the inefficiency of our federal organization was evident enough under pre-war conditions. These inadequacies, these inefficiencies, these wastes were exhibited to the country during the war at the cost of millions.

Congress has placed the problem in the hands of a very able Congressional Joint Committee. But if this joint committee succeeds in securing the imminently necessary results it will only be by full insistent support to it by public opinion. Many attempts have been made at reorganization before but all of them have gone to the same crematory—the interminable differences in opinion among the executive and legislative officials over details.

To any student of federal organization one sweeping and fundamental necessity stands out above all others, and that is that the administrative units of the government must be regrouped so as to give each of the great departments more nearly a single purpose. The hodge-podge of aims in certain administrative branches is scarcely believable when we consider our national pride and skill in organization. Such functions as public domain, public works, assistance to veterans, public health functions, aids to navigation, to industry, to trade, purchasing of major supplies, are each and every one scattered over from four to eight departments, most of which are devoted to some other major purpose.

Economies can be accomplished from a public point of view by an elimination of the overlap in these different units of administration through unification into groups of similar purpose. The real economy to the nation, however, does not lie here, however great this may be, but it lies in their more effective functioning in their daily relation to the public. The extra cost imposed upon business in general in the determination of the relation of any particular business to the different functions of the government, with the unnecessarily duplicating interferences and demands, is a real charge on national wealth, probably as great in some directions as the actual costs of the administrations themselves.

Of equal importance with economy is to secure effective concentration of government effort into service to the community. No constructive vision or policies can be built around a national service directed by from two to ten Cabinet members, more especially when this particular purpose is a side issue to all of them.

We have also some confusion between executive, advisory, and semi-judicial functions. One of the tendencies of government both local and national during the last twenty years

has been to add executive functions to commissions and boards created primarily for advisory or regulatory purposes. It requires no argument with our business public that the executive functions can not rise to high efficiecy in the hands of government boards where from the very nature of things each member has a separate responsibility to the public and is primarily engaged in a semi-judicial function.

Furthermore, during the last few years there has been a great growth of independent agencies in the government reporting directly to the President until his office is overburdened almost beyond the point of endurance. The original and sound conception was that the executive functions should be reported up to the President directly through his Cabinet officials. Not only do these outside functions today overburden the President but they render co-ordination with executive departments extremely difficult. It is neither possible nor advisable to place all these outside organizations into the departments, but much could be done to mitigate the situation.

DEPARTMENT OF COMMERCE

I have daily evidence in the Department of Commerce of all these forces. The question of governmental aids to navigation is not by any means one of the principal functions of our government, but it must be a sore trial to the hardy mariner. He must obtain his domestic charts from the Department of Commerce, his foreign charts from the Navy Department, and his nautical almanac from the Navy Observatory—and he will in some circumstances get sailing directions from the Army. In a fog he may get radio signals from both the Navy and Commerce, and listen to foghorns and look for lights and buoys provided him by Commerce; if he sinks his life is saved by the Treasury. He will anchor at the direction of the Army, who rely upon the Treasury to enforce their will. His boilers and lifeboats are inspected by the Department of Commerce; his crew is certificated by one bureau in Commerce, signed off in the presence of another, and inspected at sailing by the Treasury, and on arrival by the Department of Labor.

The moral of all this is that economy could be made by placing most of these functions under one head, not only economy to the government but to the mariner. Congress would know what it spends in aid to navigation and the government could develop definite policies in giving proper assistance, and lastly could remove from the hardy mariner's mind his well founded contempt for the government as a business organization.

The economic changes in the world, growing out of the war, and their reflex upon our trade and industry make it vital if we are to maintain our standards of living against increasing ferocity of competition that we shall concentrate and enlarge our national effort in the aid, protection, stimulation and perfection of our industrial and commercial life. There can be no real Department of Commerce or commercial policies to these broad purposes so long as the instrumentalities of the government bearing on these questions lie in half a dozen departments.

We want no paternalism in government. We do need in government aids to business in a collective sense. In a department we do not want to either engage in business or to regulate business. We need a department that can give prompt and accurate diagnosis from both a foreign and domestic point of view of economic events, of economic tendencies; of economic ills; that can promptly and accurately survey economic opportunity, economic discrimination and opposition; that can give scientific advice and assistance and stability to industry in furnishing it with prompt and accurate data upon production, supplies and consumption; that can co-operate with it in finding standards and simplifications; than can by broad study promote national conservation in industry and the elimination of waste; that can study and ventilate the commercial side of our power possibilities; that can study and advise national policies in development of rail, water, and overseas transportation; that, in fact, covers, so far as government functions can cover, the broad commercial problems of trade, industry, and transportation. This can be accomplished more by co-ordination of existing governmental facilities than by increased expenditures.

Notes From Foreign Fields

BARRANQUILLA, THE KEY CITY OF COLOMBIA, SOUTH AMERICA

BY GEORGE C. BUNKER
Sanitary Engineer, Balboa Heights, Canal Zone

LIKE many other South American cities Barranquilla, Colombia, has grown so rapidly in the last few years that it is decidedly congested. It feels keenly the lack of houses, dock facilities, public utilities, paving and sewers and an improved water supply. Its geographical location near the mouth of the Magdalena River, the commercial highway of the whole country puts it inevitably into a key position. Already 80 per cent of the foreign commerce of Colombia passes through the city to and from the interior. Three years ago there were four banks; now there are eleven, some operated by Colombians and others recently established to assist foreign trade as branches of American and Canadian institutions.

The port for Barranquilla is Puerto Colombia, which is connected to the former by an 18-mile railroad owned by an English company. Steamers of 14 lines call at this port for passenger and freight traffic. One well-built pier, extending out into the harbor for one mile accommodates four ships. It is entirely inadequate, for during the current year there has been such a congestion of freight on this pier, due to the lack of warehouses and of rolling stock to handle the unusually large incoming shipments of general merchandise, that it has not been unsual for ships to lay at anchor for several days waiting for some other steamer to move away from the pier. The loading and discharging of cargo as well as its transfer to Barranquilla proceed slowly.

Engineers and others who are called upon to make a trip to Colombia are advised to take all instruments and material as baggage, in cases provided with handles and not weighing over 250 lb. each. Excess baggage is more expensive than freight but it will pass through the Custom House with comparatively little delay.

When the bar at the mouth of the Magdalena River has been dredged ocean-going steamers may discharge and load their cargoes at piers built opposite the city. The necessary surveys of the lower end of the river have been made by American engineers and the plans of the work will be delivered to the promoters before the end of 1920.

From the Plaza Bolivar in the business district on low ground near the river there is an easy slope to a ridge of low hills although high enough to take advantage of the trade winds. The urbanization of a section of these heights which overlook the river and ocean was started two years ago by an American mining engineer, K. C. Parrish, with the result that a considerable number of fine modern residences have been erected, together with well laid out streets, cement side walks and gutters. In this section tarvia-covered macadam roads have eliminated the dust, the mosquitos are not so annoying and the air is much cooler than in the lower part of the city.

No Paving or Sewers—The streets are unpaved, with the result that one moves in an atmosphere of dust. As the houses are built close to the sidewalks a large amount of dirt is carried through the rooms by the air currents.

The covering of the nose by men and women, as they walk and ride, to prevent the breathing in of the dust is a common sight.

There is no sewerage system. In the business section a few private sewers discharge into the canal, and in the *patios* of the better class of houses, large cesspools or septic tanks have been provided as receptacles for the toilet flushings and waste water. They are cleaned at intervals of one to four years, depending upon the size of the tank and the number of inhabitants in the house.

On some of the streets in the business section the storm water frequently rises above the sidewalks and is kept from running into the stores only by the use of planks inserted on the door-sills. In general the sidewalks have been built high enough to avoid flooding, but the street intersections are generally so low that it is impossible for the pedestrian to cross from one side of the street to the other without making a detour of one or more blocks.

Both pavements and a sewerage system are under consideration, a survey of the city having been made by American engineers during the first half of 1920. As in the States many desired and necessary improvements in Colombia are delayed for lack of funds. It seems probable that these improvements will be started in 1921.

Several motor bus companies operate in competition with the mule-drawn street cars and carry most of the people who ride. Coaches and jitneys are also available. The number of automobiles is steadily increasing although the mileage of suitable roads is small. Projects are on foot to build a road to Cartagena, 90 miles to the west, and work has been started on several routes up and down the river and into the back country.

Building Materials—The city is underlaid with a limestone formation, covered with a thin layer of sand in the higher sections and a deep layer in the lower sections. Consequently sand is readily obtained for building purposes. Rock for concrete is difficult to obtain in large quantities and of suitable size, as there is only one small crusher and the limestone must first be broken by hand. Gravel is not available in the immediate vicinity. Cement has to be imported but lime is made in rough native kilns.

Native-made bricks of poor quality and of low strength are used almost exclusively in building construction. Both the interior and exterior walls of the buildings are plastered over. The supply of native lumber is insufficient to meet the demands of the building work and is imperfectly seasoned, the logs going almost directly from the canal through the sawmill to the consumer. A seasoning kiln will soon be installed. Bricks are generally used for roofs instead of tiles, two layers laid upon wooden rafters being used. A large number of the older houses are covered with thatched roofs made of palm leaves, and as they are cheaper than the brick roofs they are still used to a limited extent. Pre-war wages of from $1.20 to $1.50 for native carpenters and masons for a 10-hour day have risen to from $2 to $3 for an 8-hour day.

There is a small hospital operated by American doctors and a company has recently been formed from local capital to build a larger one. It is estimated that the sum of $1,500,000 is carried to Panama yearly by Colombians who go there for operations and treatments.

In presenting this article the writer desires its readers to understand clearly that he has endeavored to give an impartial review of conditions as he has seen them during visits in the latter part of 1919 and in June and August of 1920. His unfavorable criticisms are made neither as "knocks" nor in an unfriendly attitude toward Colombia, for in truth he feels kindly disposed toward that country and counts a considerable number of Colombians as warm friends, men as courteous and honorable as one may wish to meet in any part of the world. Many unfavorable conditions are noted but the outstanding features are that sanitation has taken an upward trend in Colombia and that Barranquilla has given a strong impetus to the movement by the disinfection of her water supply and the decision to erect a purification plant.

Board Finds Columbia Basin Cost Estimates Are Low

THE Columbia Basin project, a plan for the irrigation of 1,753,000 acres in the state of Washington, which was described in *Engineering News-Record* Nov. 11, 1920, p. 944, has been reviewed by a board of engineers appointed by A. P. Davis, director of the U. S. Reclamation Service. The board consisted of D. C. Henny, James Munn and D. T. Pearse; their work included both an analysis of the report submitted by the Columbia Basin survey commission and a field examination of the points where the principal engineering works are proposed. Their findings as submitted to the director of the Reclamation Service comprise 21 typewritten pages and, in the main, state that while the estimates of the commission are low, the project should receive further study. The engineers who made the studies and prepared the report for the commission are commended highly.

In commenting on the commission's cost estimates, which are $190 per acre for land ready to start farming, the reviewing board states that (a) it may not be possible to place sagebrush lands in the hands of the irrigator at the price estimated; (b) the cost of preparation for much of the land will be more than is estimated; (c) the incoming farmer will probably be unable to buy much of the land heretofore cultivated at from $18 to $20 per acre; (d) additions must be made to construction costs.

Considering the three projects investigated, the data is compared in tabular form and the comparative advantages discussed. No conclusions on the financial and organization plans are given, the opinion of the board being that these would be premature at present and should await the completion of the commission's supplemental report. In recommending further engineering studies, which the board urges should be undertaken at an early date, the feasibility of the Columbia River dam should be determined; consideration should be directed particularly toward laying out canals so as to use natural stream beds as carriers, thereby relieving high line canals from part of their load; and the advisability of including lands south of the Snake River and in other outlying areas should be weighed carefully.

If further action is required before financial plans are finally developed and feasibility has been considered, the board recommends that $150,000 be provided for further studies and that of this $50,000 might well be used for Columbia River dam site borings and related work, the expenditure of the balance being conditioned upon the resultant comparative showing of the gravity and the pumping projects.

LETTERS TO THE EDITOR

If you have ideas that would interest engineers and contractors we shall be glad to give them space here. We urge, however, that you be brief so that a wide range of subjects may be covered in the available space.—The Editor.

A City That Is Recognizing Engineers

Sir—If you would like to tell the readers of *Engineering News-Record* about a city that is recognizing its engineers, tell them about Memphis. Recently one of our city commissioners resigned and an engineer was appointed to fill the vacancy. This makes two engineers on the city commission of five. In addition, Memphis has the following engineers in important offices: city clerk, chairman water-works commission, city engineer, assistant city engineer, superintendent of water-works and city sanitary engineer. All of these men are engineers of standing who have the full confidence and respect of their fellows in the profession. All of them are members of the Engineers' Club of Memphis.

The engineer-commissioners are Major Thos. H. Allen (formerly Capt. Allen, 306th Engrs.), commissioner of fire and police, and Harry Northrop Howe, commissioner of streets and bridges.

A. L. DABNEY.

Memphis, Tenn., March 25.

[Some reflections suggested by the foregoing letter will be found in our editorial columns.—EDITOR.]

The Belle Isle Bridge and the Status of the Engineer

Sir—Engineers are supposed to be professionally competent to direct the use of materials and men in a safe and economical manner; to produce definite results devoid of the element of gambling or "taking a chance" with a client's money in experimental directions without full advice to the client.

It has been said that all engineers look alike to the layman; and from recent articles in *Engineering News-Record* in relation to the Belle Isle Bridge at Detroit it does not appear that any exception need be made of Detroit citizens who selected the consulting board for the Belle Isle Bridge.

It appears that the consulting board was not particularly pleased with the foundation prospects—that they were not sure of the footings, so they made some borings and tested a pile. The test shows that under a steady load of 20 tons the pile settled progressively for 32 days without coming to rest; and without testing a group of piles to determine whether the load per pile should be more or less the consulting board decided that a load of 18 tons per pile would be safe.

That looks like taking a chance, or gambling on one pile with a $5,000,000 structure at stake.

It would be difficult to select a type of construction more destructive to yielding or pile foundations than the cantilever design used in this case. The alternating and rolling action produced by the moving load may be compared to that of the rolling bascule bridge that has been destructive to several foundations in this country after safely sustaining a greater stationary load.

With the loads provided for in this structure the maximum rolling action or moment will be 9,130 foot-tons to the right and to the left, or a variation in load on the outer row of piles under the 135-ft. spans, amounting to 304 tons, which could be reduced to 62.25 tons by common construction. This is gambling on the safety of a confessedly suspicious foundation.

If the hearts of the engineers, architects and the people are set for a cantilever bridge, and this novel type of a cantilever bridge, the stresses on foundations and cost of construction can be materially reduced by using shorter arms and longer suspended spans, with distinctly better conditions in service at the hinges.

On the foundations which it is admitted can have a factor of safety of only about one, it is proposed to construct a superstructure with a factor of safety of four. Can any engineer give a plausible reason for such a combination?

The doubt of the consulting board regarding the foundation conditions is apparent from reading pages 55 and 56 of their report, and regarding the superstructure we find their first recommendation "that it should be as light as possible."

In the design submitted for construction we find nine steel ribs formed into imitations of arches and covered with a masquerade costume of concrete weighing probably four times as much as the steel alone. For economical construction and lightness, less than half the number of ribs should be used and the concrete be replaced with a coat of paint.

In numerous combinations of structural steel shapes and concrete the results have not proved satisfactory. As an example see the report on Third St. Bridge in Dayton, Ohio, in *Engineering News-Record*, March 24, 1921, p. 511, in which it is estimated that 85 per cent of the surface of steel was exposed to corrosion by failure of concrete to adhere to the steel. Note from the report that while this bridge is only sixteen years old the "steel ribs are decidedly rusty" throughout the structure and that their location is clearly evidenced by cracks, leaking water, streaks of rust on the surface and by the scaling off of the concrete exposing the steel. For this condition the engineer admits he can see no remedy and that it "will limit the life of the bridge to comparatively few years."

While concrete is easily one of the most valuable materials of construction, it can only serve the engineer particularly well when used in compression. It is too heavy for a costume, or for a mantle to cover a skeleton, and give it the solid appearance of an arch, and it is not an ideal substitute for paint for protecting steel.

It now appears that the artistic temperament that was to be satisfied by the deception practiced in this freak design was due to cost the taxpayers about $2,000,000, or the same engineers could not have undertaken the commission to redesign the structure and retain the same length, width, height, strength and general appearance for $2,000,000 less than the prices bid upon two previous occasions.

If the client received competent and loyal service in each case it is but fair to expect that when the first set of proposals amounted to over $5,000,000, the client was advised that $2,000,000 of that was for decorations. If the client was not so advised until an outside engineer forced the issue, what confidence can the layman now be justified in placing in the engineers? In which case were they true to their trust?

Is the Detroit Engineering Society upholding the standards of engineering or slaughtering the reputation of engineers generally by countenancing such procedure?

Chicago, April 13. J. W. PEARL.

Sir—The whole question of the Belle Isle Bridge goes back to the foundation problem, and unless this is successfully solved the bridge will be unsatisfactory no matter what the nature of the superstructure. The foundation should, if possible, be designed to stay put and not to settle. A foundation on piles is a cheap substitute for a rock foundation and it may or may not be entirely staisfactory. In some localities it is the best foundation obtainable. Heavy structures in New Orleans are now built on piles and some settlement is always expected. An inch or more of settlement is not serious when all the footings settle alike. It might be wise for the Detroit City Council to consider sinking piers to bedrock, using open reinforced-concrete caissons such as are now being put down for the new highway bridge across the Missouri River near Bismarck, North Dakota.

If the opinion of the commission that a pile foundation is the only practicable solution be accepted, the two designs now before the council may be compared on the basis of the merits of the superstructure. In either case, substantial settlement of one foundation pier without equivalent settlement of the other piers at the same time would destroy the

alignment and call into play large indefinite stresses which in the official design would be concentrated on the 6-in. pins connecting the ends of the umbrellas and on the two 2-in. foundation bolts. In the Luten design these stresses would be more evenly distributed throughout the structure, which is well reinforced.

The question of lateral thrusts against the foundation piers seems to be met in the Luten design by cleverly balancing the arches, and any possible unbalancing due to uneven settlement would be taken care of by the inclined piles.

Comparing the designs I note that in the use of materials the Luten design is very skillfully economical, while the official design is not very clever in this respect, due to the limitations under which it was made. The Luten design with its wide mat and well reinforced pier is strong and light. The official design is heavier and weak at the crown joint and at the piers. In appearance the Luten design with its secondary arches is more attractive than the official design, and in cost the Luten design again has the advantage. It is a clever piece of engineering and by no means a cheap substitute.

The Detroit City Council is in a dilemma. It must either get more money for this project, or wait until prices go down enough to bring the cost of the official design within the means available, or abandon the official design and adopt one that can be built now with the fund on hand.

I have never met Mr. Luten and he does not know me, but it appears from the material published that he has done the City of Detroit a real service by submitting his design.

On the ethical side it is quite as much to be regretted that an engineer should allow a client to get into a dilemma as for a doctor to allow a patient to get so sick that some other doctor is prompted to suggest a proper remedy.

Minneapolis, Minn., April 15. WILLIAM B. NEWHALL.
Consulting engineer.

Higher Stresses for Bridge Pins

Sir—I appreciate the comments made by A. W. Carpenter in your issue of April 14 on my article on "Higher Stresses for Bridge Pins," which appeared in the March 24 issue. Permit me to offer a few words in reply.

Mr. Carpenter objects to my designation of the test specimens as "comparatively short beams." The tests cited in my article covered pins or cylindrical beams ranging in length from 2 to 16 diameters. The lower ratios in this range certainly constitute "short beams," to which the common theory of flexure is not strictly applicable. As the length-ratio increases, the test results approach the normal values for long beams. When the slenderness ratio reaches 16, my proposed formula

$$K = 40{,}000 - 1{,}000\ l/d$$

would give a designing stress of 24,000 lb. per square inch, which is the value allowed in present specifications.

No one can state at what ratio of length to diameter a pin becomes a "long beam." The designation is, after all, immaterial. It is the test results that count. No matter what the theoretical explanation may be, the fact remains that the tests cited showed ultimate bending resistances greater than that which the common theory would indicate, the excess rapidly diminishing as the pins became longer. With a factor of safety of 5, the results of the tests gave the working formula quoted above.

I regret, with Mr. Carpenter, that editorial limitations of space necessitated the omission from my article of information regarding the details of the tests. Exact references by page and volume to original sources were given, however, so that the interested reader could secure the desired information at first hand.

Mr. Carpenter is right in questioning the justification for suggesting that the elastic limit points follow inclined lines. I disclaim responsibility for the lines in question; they were inserted through a misunderstanding and erroneously designated by the *Engineering News-Record* draftsman.

None of the tests cited produced actual rupture. The ultimate strength was taken as the load producing a deflection too large for structural security.

The case for higher pin stresses does not rest on laboratory tests alone. Many bridge engineers know of pins in actual structures having calculated fiber stresses over 80,000 lb. per square inch. The other day W. H. Burr told me that he personally figured stresses as high as 200,000 lb. per square inch in the pins of the former railroad bridge over the Hudson River at Albany.

There is little to be gained by any further elaboration of the subject matter of my article as suggested by Mr. Carpenter. Full details of the tests can be found in the original sources cited. The results seem conclusive so far as the data extended. What is needed now is a more comprehensive series of tests, scientifically arranged and carefully analyzed, under the auspices of one of the national engineering societies, in order to throw more light on some of the important questions involved. D. B. STEINMAN,

New York, April 15. Consulting Engineer.

Perforated Pipe Filter Underdrains

Sir—The article in your issue of Jan. 27, p. 162, by Harry N. Jenks, entitled "An Investigation of Perforated Pipe Filter Underdrains," is an interesting and instructive one. Where the observations and conclusions relate to the perforated pipes themselves Mr. Jenks appears to be on perfectly safe ground. On the other hand, the placing of the gravel about the perforated pipes and the experiments showing a uniform disturbance of a thin layer of sand do not insure a perfectly satisfactory filter underdrain system. It appears to be a relatively simple matter to produce a filter underdrain system as Mr. Jenks has done, which will yield a fairly uniform backwash if the sand above it is always in a condition to take it so (which would be the case with a 3-in. layer of clean sand), but unfortunately this is not a typical practical case. Actually one part of a bed of dirty sand in a filter is more easily lifted than another. When such lifting does take place over or near a particular orifice all the orifies around about will also contribute water by cross communication in the open gravel and a progressive disturbance of the gravel at its contact with the sand will take place with failure at some period later. This phase seems to be aggravated in Mr. Jenks' design by the open spaces under the pipes and the considerable depth of coarse gravel. Curiously enough, Mr. Jenks considers this to be of importance in the opposite way. I believe that in this type of underdrain system the coarse bottom gravel should be quite shallow, of depth just sufficient to cover the pipes, and be composed of rounded stones from ½ to 1-in. maximum dimensions or less. In this way cross communication is reduced to a minimum.

At the edges and corners of a filter underdrain system of this type experience shows that the loose gravel slowly but surely creeps up the sides of the filter and this tendency is greater at the corners. WILLIAM GORE,

Toronto, Ont. Consulting Engineer.

Sir—The sizes and depth of gravel to be used in conjunction with the perforated-pipe underdrain system of water filters, discussed by Mr. Gore above, is a subject of much interest. It is also one which does not lend itself readily to experimental study on a small scale, as the factors involved are largely indeterminate.

The criticism regarding the grading of the gravel and particularly the maximum sizes of stones to be used in the bed appears to be well taken. In such matters there is always room for considerable difference of opinion as well as materially different methods of securing the desired results. The use of 3-in. cobbles along the pipes themselves, and of graded gravel from 2½ to 1½ in. in size in the intervening space up to a plane about 3 in. above the laterals, is recommended more especially to serve as a foundation for the upper layers, and in order to prevent the lodgement of gravel underneath the pipes with the possible choking of the orifices. The writer is convinced that the deep gravel bed is highly desirable, not only because of the progressively better diffusion that takes place as the

depth increases, but also on account of the added stability secured, considering the bed as a foundation for the sand above. The tendency of current practice is evidently also toward the use of deeper gravel beds than formerly obtained.

As to the grading of the gravel, considerable latitude may indeed be allowed. The writer can see no objection to using a smaller gravel than the one proposed. In fact, experiments made subsequent to the underdrain studies on a full-size cross-section of filter bed showed that it might be advisable to increase the thickness of the top layer of finest gravel to 5 or 6 in., omitting 2 or 3 in. of the coarser material. It is believed that the true function of the finer gravel at the top of the bed is to prevent the sand from working its way down to the underdrain system; it should be of sufficient depth to act as a stable sustaining medium, but should not be so fine as to be lifted along with the sand. To determine this matter more definitely, it is proposed to test a full-size unit of the Sacramento plant before placing in operation.

Referring to the cross-communication mentioned by Mr. Gore, it appears doubtful whether material that would come under the definition of "gravel" would actually prevent the water from passing from any point to any other within the bed, because of the very low loss of head through gravel.

Discussion of this subject; and particularly experimental data, should prove of much value in the perfecting of a type of filter underdrain which possesses so may inherent advantages.

HARRY N. JENKS,
Sacramento, Cal., March 21. Filtration Division.

Sir—With regard to the article by H. A. Jenks in *Engineering News-Record*, Jan. 27, p. 162, on "An Investigation of Perforated-Pipe Underdrains," I think all engineers have long realized the advantages of thick beds of gravel, 18 in. and even greater in thickness. The greatest value of the experiments at Sacramento is that they reduce to figures the relation between gravel thickness, gravel size, size of laterals, length of laterals and perforations. Once this has been done, one wonders at the great length of time we have been willing to worry along without these data, simply basing design on previous practice.

One reason why basic factors of design are not more frequently determined than they are, is because engineers have such difficulty in persuading their clients to spend reasonable amounts on preliminary investigations. In this case the engineers have been very fortunate in inducing the city of Sacramento to approach its water supply problems on a rational engineering basis.

PAUL HANSEN,
Chicago, Feb. 21. Consulting Engineer.

Selling Cement Through Dealers

Sir—I read with interest an editorial comment on page 410 of your issue of March 10, entitled "Indictment of Cement Companies."

I believe it is a fact that no contractor can purchase cement except through the local dealer, it making no particular difference whether the contractor's job is large or small. If the contractor should purchase through a cement company that did not have an agent in the particular locality, the cement company would charge the contractor a market price and then look for a dealer in the locality to handle their brand, using as an argument that they have sold direct and the dealer might just as well have the benefit of the dealer's discount. The dealers we believe receive all the way from 5 to 20 cents a barrel and in some cases more. This, on large contracts, adds materially to the expense of the contract.

We do not think that this is a proper way of doing business between large contractors and the cement mills. Everyone knows that at the present time the price of cement is exactly the same from any mill and it looks as if there must be an arrangement between the various mills in order to assure themselves uniformity in price.

Do you know of any reason why contractors should pay local dealers commission as above outlined?

Springfield, Mass., S. M. GREEN,
March 31. President, Samuel M. Green Co.

[The following letter sent by the Atlas Portland Cement Co., in response to an inquiry similar to that of Mr. Green, gives one cement company's position on selling through dealers. It is, we believe, representative of that of other cement manufacturers as well.—*Editor.*]

"You ask if we sell to contractors by carload or if we are tied up by agreement to sell only to dealers. We certainly are not tied up by an agreement of any kind, but it is our policy to sell through the dealer, and we are quite sure that when you understand the analysis of our business you will feel it has been a sound policy.

"We distribute on an average ten million barrels of cement a year. Of this amount 60 per cent is sold to dealers throughout the country, goes into their warehouses, and is shipped in small lots by them to customers unknown to us. We estimate that about 5 per cent of the balance of our output goes into government work. The remaining 35 per cent is shipped on contracts placed with dealers.

"Now the question you would naturally ask is: 'Why do you ship on these contracts through the dealer instead of direct to the contractor?' We believe that fully half of this 35 per cent is controlled by the local dealer; he is better able to judge of the credit; he sells the contractors sand, gravel and other building materials; and he performs a service that entitles him to that business, and oftentimes has influence that would prevent our getting it even if we attempted to. On the other half of the 35 per cent we believe that we could go and get the business direct from the contractor but we do not do it for the reason that it is good business to give the dealer the 17½ per cent because of the 75 per cent which he gives us.

"We do not believe we could buy a suit of clothes, or a hundred suits of clothes, to wear, direct from Hart, Schaffner & Marx. They would refer us to one of the dealers who handled their brand.

"We believe that it cannot be the policy of sound dealers—and most of the Atlas dealers are sound—to make their margin of profit too large. You must remember, however, that oftentimes their cost of doing business is high and that they hold an organization that is expensive, especially when business is light. We dare say that there are abuses, and that last year when cement was scarce in some locations advantage was taken of this and too high a price asked; but it will not do in the long run for any dealer to assume that attitude, because, if our judgment is correct, it will be far better for him to stimulate buying and get the volume than to expect to make too much on one transaction. The wise dealer who adopts that policy will get most of the business and build up a trade that will make the other fellow pretty uncomfortable.

"We think that you will find upon examination that the prices we have secured as a manufacturer have been fair, and that the price of cement has not gone up so much as the average of other building materials. The Atlas company could have sold hundreds of thousands of barrels of its cement last year at a dollar a barrel, at least, more than it asked. We did not refuse this business from any highbrow point of view but because we thought it was better to take care of our regular clientele and maintain our reputation for dependability, than to make an extreme profit over a short period of time."

Filtration of Great Lakes' Water

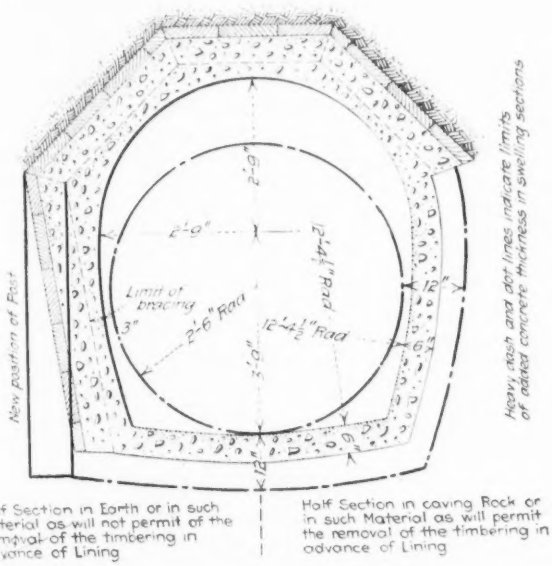
Sir—In an editorial note appearing in your issue of March 24, p. 492, on "Filtration of Great Lakes, Water," you state that in the adoption of filtration "Cleveland led the way." Although in your opening sentence you qualify your statement by the word "large" and although later on you say that many of the smaller cities on the Great Lakes adopted filtration before the larger ones, yet it seems likely that many of your readers may not catch these qualifying words and that therefore injustice may be done to the city of Erie, Pa., which has had a 24,000,000-gal filtration plant in successful operation for the past eight years. In fact, the Erie plant was in use before Cleveland began to mature its plan for filtration. J. N. CHESTER.

Pittsburgh, Pa., March 26.

HINTS FOR THE CONTRACTOR

Circular Forms and Tamped Concrete Hold Swelling Tunnel Ground

IN CONSTRUCTING the San Pablo tunnel, a 14,000-ft. bore driven to carry water from the San Pablo reservoir to the west side of the Berkeley hills near Oakland, Cal., the line occasionally traversed a serpentine formation that would swell after being exposed to the air. Where this condition was met 12 x 12-in. segments and posts were substituted for the 6 x 8-in.


New position of Post
Limit of bracing
Heavy lines and dot lines indicate limits of added concrete thickness in swelling sections
Half Section in Earth or in such Material as will not permit of the removal of the timbering in advance of Lining
Half Section in caving Rock or in such Material as will permit the removal of the timbering in advance of Lining

SECTION SHOWS TUNNEL LINING ORDINARILY USED AND THAT EMPLOYED IN SWELLING AREAS

timbers otherwise used, the spacing between sets was reduced to 18 or 24 in., and lagging was omitted. As the ground swelled and came in between the timbers muckers picked it out from between and behind the sets, thus relieving the pressure. After a period of about ten days to two weeks the swelling action ceased. The cessation was ascribed to the penetration of the air into the material as far as it would go and the stabilizing of the strata under the new conditions.

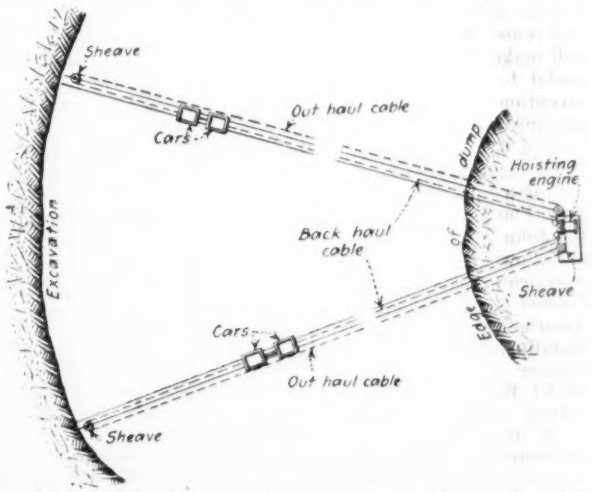
A more difficult situation was encountered, however, at a point about 2,700 ft. from the west portal. Here there were two stretches, 110 and 232 ft. long respectively, where the swelling showed no tendency to decrease after the lapse of the usual time despite the large amount of material that was continually taken out. Moreover, in these sections the methods previously successful could not relieve the pressure fast enough. The material crowded in from all sides as much as 2 ft. in 24 hours and several times wrecked the track, as well as air and water lines. The timbers could not be replaced fast enough to hold the tunnel, and the engineer's report on this part of the work states that "the crushing and rumbling of these timbers was deafening." Operations at the heading were then closed down and concreting was commenced.

The method used by the concreting crew at the swelling sections was to timber ahead for a length of 30 to 60 ft., setting the timbers back far enough to allow 12 in. for the concrete lining and 2 to 3 ft. for the swell of the material. Concrete forms, consisting of 5-ft. corrugated-iron pipe, delivered to the job in semi-circular sections 5 ft. long, were then set to grade and a mixture of 1:3:5 concrete, mixed "rather stiff," was rammed and tamped in place. Twenty to thirty lineal feet of lining was placed in this way by each shift. The timbers were left in place, of course, as there was no means of removing them after concreting. Both stretches of the continuously swelling earth were successfully lined in this way, and no damage to the concrete due to pressure was reported during the period of setting. The tunnel was made in horse-shoe section, 5 ft. 6 in. wide and 6 ft. 6 in. high for convenience in driving, but the 5-ft. pipe used in the swelling sections is expected to afford ample capacity for the maximum flow of water.

The work was done for the East Bay Water Co. by the Bates & Borland Contracting Co. George W. Hawley was resident engineer for the water company.

Cable Haulage for Dump Cars

In distributing about 7,000 cu.yd. of excavated material with a haul of only a few hundred feet a cable system with dump cars was installed to eliminate the use of teams. Two 24-in. tracks were laid from the excavation to converge at a hoisting engine, the tracks serving a triangular area about 250 ft. wide and 300 ft. long. On each track were two 1½-yd. dump cars coupled together. A ¾-in. cable led from the head of one car to a drum on the engine. From the rear end of the other car a similar cable was led to a block hitched to a deadman at the excavation end of the track and then back to another drum on the engine. The



engine remained in position for the entire work, but the tracks were shifted to suit the loading and dumping operations. This plan was worked out by J. M. Egan, Jr., of the Egan Construction Co., Aurora, Ill.

NEWS OF THE WEEK

New York, April 28, 1921

New York Has New Water Power Act

Governor Miller, of New York, last week signed the water-power bill passed by the recent legislature. This act creates a water-power commission, consisting of the conservation commissioner, state engineer, attorney-general, president of the Senate and speaker of the Assembly. This commission shall collect information regarding water power in the state and issue 50-year licenses authorizing the diversion and use for power, "or other purposes," any of the waters of the state in which the state has a proprietary right or interest. In general the operations of the law are similar to those of the Federal act.

Engineer Becomes President of National Municipal League

Col. Henry M. Waite, New York City, has been made president of the National Municipal League to fill the vacancy caused by the resignation of Charles E. Hughes on becoming Secretary of State. Col. Waite was city manager of Dayton, Ohio, until he resigned, and went to France, where he served in the transportation department of the American Expeditionary Forces. Before becoming city manager at Dayton Col. Waite was city engineer of Cincinnati.

Engineer Mission to England

To express the obligation which the world owes to the engineers of Great Britain for the part they played in winning the war, the organized engineers of America will send a mission to London this summer. This mission, consisting of nationally known engineers and representing the Founder Societies, will make the award of the John Fritz medal to Sir Robert Hadfield for his invention of manganese steel at the opening meeting of the British Institution of Civil Engineers on June 29.

The deputation to England will consist of a representative of each of the four Founder Societies represented on the John Fritz Medal Board of Award as follows: Charles T. Main of Boston, American Society of Civil Engineers; Colonel Arthur S. Dwight of New York, American Institute of Mining and Metallurgical Engineers; Ambrose Swasey of Cleveland, the John Fritz Medal Board of Award and American Society of Mechanical Engineers; Dr. F. B. Jewett of New York, American Institute of Electrical Engineers. Dr. Ira N. Hollis, president of Worcester Polytechnic Institute will bear the message from the American engineers.

New Federal-Aid Road Bill Calls for Highway Classification and State Systems

Measure Drafted by Highway Officials Contains Rigid Maintenance Requirements—Government Funds for Roads of "Interstate Character" Only

(Washington Correspondence)

Drastic revision of the conditions under which states may receive federal aid in the construction of highways is embodied in a bill, drafted by the executive committee of the American Association of State Highway Officials and introduced in the House of Representatives this week by Cassius Dowell of Iowa, amending the present Federal-Aid Road Act. The bill requires each state receiving federal aid to designate a connected system of roads, "interstate in character," not to exceed 7 per cent of its total road mileage, and to classify the roads of this system in two groups, primary or interstate and secondary or intercounty. Federal money is required to be matched with state funds. The expenditure of federal funds is specifically limited to the roads forming this system and the Secretary of Agriculture is empowered to require modifications or revisions of the systems selected by the states.

There is a clause in the bill requiring at least 60 per cent of the federal-aid allotments to be expended on the primary or interstate roads of the state systems. Rigid maintenance requirements are embodied in the amendments to the existing law. No project will receive government approval until a state has provided funds adequate for maintenance under direct state control. Where maintenance is neglected, the Secretary of Agriculture is authorized to withhold federal-aid money and to put a highway in proper condition by drawing upon the state's allotment of federal funds for that purpose. Prior to its introduction in the House the draft of the bill was submitted to the President and to the Secretary of Agriculture. A number of changes suggested by the Secretary of Agriculture were embodied in the bill.

Comment on Bill

According to W. C. Markham, legislative representative of the American Association of State Highway Officials, that organization is unanimously behind President Harding's demand for continued federal co-operation with the states in building highways, based on a system of roads interstate in character and maintained by daily care with state funds. Accepting as a fixed policy President Harding's statement in his message that:

"With the principle of federal participation acceptably established, probably never to be abandoned, it is important to exert federal influence in developing comprehensive plans looking to the promotion of commerce and apply our expenditures in the surest way to guarantee a public return for money expended";

the state highway officials propose, according to the language of the pending bill, that

"in approving projects to received federal aid the Secretary of Agriculture shall give preference to such projects as will expedite the completion of an adequate and connected system of roads, interstate in character. Before any projects are approved, each state through its state highway department, shall select or designate not to exceed 7 per cent of the total road mileage of said state as shown by the records of the state highway department at the time of the passage of this act. Upon this system all federal-aid apportionments shall be expended.

"Roads which may receive federal aid shall be divided into two classes, one of which shall be known as primary or interstate roads and shall not exceed three-sevenths of the total mileage which may

Store-Door Service From New York State Barge Canal

A plan for store-door delivery service at Buffalo and New York has been adopted by the Inland Marine Corporation and the Transmarine Corporation operating on the New York State Barge Canal. Superintendent of Public Works, Charles L. Cadle, has been informed by the Canal Carriers' Association that merchandise handled from New York City to Buffalo by canal will be delivered direct to the warehouse of the consignee at a net cost 20 per cent lower than the railroad rate. At New York City, where it is impracticable for the canal lines to operate delivery trucks, an allowance of 7c. per hundred weight will be made shippers to cover the cost of delivery to and from canal terminals. Shippers at New York and Buffalo have complained that the cost of trucking to and from the canal terminals exceeded the saving in the rate. It is expected that the new arrangement will influence a large volume of tonnage.

receive federal aid, and the other of which shall be known as secondary or inter-county roads and shall consist of the remainder of the mileage which may receive federal aid

"The Secretary of Agriculture shall have authority to approve in whole or in part the systems as designated or to require modifications or revisions thereof; provided, that the states shall submit to the Secretary of Agriculture, for his approval any proposed revisions of the designated systems of roads above provided for. Not less than 60 per cent of all federal aid allotted to any state shall be expended upon the primary or interstate roads until provision has been made for the improvement of the entire systems of such roads. Whenever provision has been made by or in behalf of any state for the completion and maintenance of a system of interstate and inter-county roads equal to 7 per cent of the total milage of such state, as required by this act, said state, through its state highway department, by and with the approval of the Secretary of Agriculture, is hereby authorized to add to the mileage of the interstate and inter-county road system as funds become available for the construction and maintenance of such additional mileage."

With the foregoing section added to the present law the state highway officials believe that the position taken by the President will be met where he says: "Congress ought to prescribe conditions to federal appropriations which will necessitate a consistent program of uniformity which will justify the federal outlay."

To meet criticisms of ill-advised highway financing it is proposed that any state desiring to avail itself of the benefits of federal aid shall, not later than two years after the adjournment of the first regular session of the state legislature from and after the passage and approval of the act, provide state funds each year at least equal to the amount apportioned for such year by the Federal Government to said state for the construction of highways. It is believed that this requirement will meet the statement of President Harding when he said that "Congress cannot justify a mere gift from the federal purse to the several states to be prorated among counties for road betterment."

PENALTY FOR LACK OF MAINTENANCE

To prevent neglect of highway maintenance the bill proposes, first, that the Secretary of Agriculture

"Shall not approve any projects in any state until said state shal provide a state fund adequate for the maintenance of federal-aid roads, and by law shall place said maintenance work under the direct control of the state highway department"; and, second, "To maintain the rural post roads constructed under the provisions of this act shall be the duty of the state. If at any time the Secretary of Agriculture shall find that any road in any state constructed under the provisions of this act is not being properly maintained, he shall give notice of such fact to the highway department of such state and if within 60 days from the receipt of said notice said road has not been put in a proper condition of maintenance by the state highway department then the Secretary of Agriculture shall thereafter refuse to approve any project for road construction in said state, until such road has been put in a condition of proper maintenance, and if, within 90 days from the receipt of said notice, the said road has not been put in a proper condition of maintenance then the Secretary of Agriculture, in addition to such refusal to approve any further project for road construction in said state, shall proceed immediately to have such road put in a condition of proper maintenance and charge the costs thereof against the federal funds allotted to such state. Upon the reimbursement by the state of the amount expended by the Federal Government for such maintenance work, said amount shall be paid ino the United States Treasury to the credit of miscellaneous receipts and the Secretary of Agriculture shall then approve further projects for said state."

When it is appreciated that a refund by the state goes back to the general treasury of the Federal Government and is lost forever to that state, it is believed by the proponents of the bill that this provision will give adequate protection to the funds expended and give a patrol system of maintenance essential to present traffic demands throughout the country.

Today the expenditure under the direction of the Bureau of Public Roads is more each year than the total expenditure of all the rest of the Department of Agriculture. Whether because of the growing importance of this work, the Bureau of Public Roads should be changed to a department, is said to be of no vital concern to the state highway officials who have come in contact with the bureau and testify to its ability to function creditably when measured with any other body created by Congress to carry on some stated work.

There are those who think that a Federal Highway Commission should be charged with this work, operating directly under the supervision of the President; others think that there should be a Department of Public Works and that under such an organization roads would find an influential position; still others, since the highways have become such an important factor in transportation, believe that all methods of transportation, water, rail, road and air, should be controlled by the Secretary of Commerce.

The state highway officials, according to their spokesmen, are not so much concerned about who shall administer the duties as they are that the government shall recognize the fact that it is as much a federal function to co-operate with the states in road building as it is for the states to aid their minor subdivisions.

Senate Passes Resolution To Investigate Railroads

A resolution to conduct an investigation of the railroad situation, and particularly operating expenses, was passed by the Senate April 19, 1921, after being introduced the week before by Senator Cummins, chairman of the Senate Interstate Commerce Committee. Under the terms of the resolution the committee is authorized to investigate operating revenues and expenses of the railroads since 1912, the reason for the high maintenance cost since March 1, 1920, the falling off of traffic, the efficiency or inefficiency of the railroad management during Federal control, and the best means of bringing about a condition that will warrant the Interstate Commerce Commission in reducing freight and passenger rates. Under the resolution the committee would be authorized to employ counsel and experts and subpoena witnesses for hearings.

Nichols New President of M. I. T.

Dr. Ernest F. Nichols, past-president of Dartmouth College and, for the past year, director of physical science at the Nela Park Research Laboratory of the National Electric Lamp Association, Cleveland, has been elected president of the Massachusetts Institute of Technology. He was born at Leavenworth, Kan., in 1869 and received the degree of B.Sc. from Kansas' Agricultural College in 1888, M.Sc. from Cornell University in 1893 and Sc.D. from Cornell in 1897. From 1889 to 1892 he was a graduate student in physics at Cornell and from 1894-96 at the University of Berlin. In 1903 he received the honorary degree of Sc.D. from Dartmouth College and later LL.D. degrees from Colgate, Clark, Wesleyan, Vermont, Pittsburgh and Denison Universities and Dartmouth College. His early career includes professorial work in physics at Colgate University, Dartmouth College and Columbia University. From 1909-1916 he was president of Dartmouth College and from 1916-1920, professor of physics at Yale University. From 1907 to 1909 he served as research associate at the Carnegie Institution, Washington, D. C., and from 1917 to 1919 was connected with the Bureau of Ordnance, U. S. N. In 1905 he received the Rumford Medal of the American Academy of Arts and Sciences. Dr. Nichols was a collaborator of the *Astrophysical Journal* and has contributed many papers to scientific journals on radiation and other subjects. While working for the Bureau of Naval Ordnance he developed valuable optical devices whose character has never been disclosed by the government. While a student at the University of Berlin, he discovered the metallic reflection of quartz and its anomalous dispersion in the infra-red spectrum.

Construction of Two Short Lines Approved by I. C. C.

On April 19 the Interstate Commerce Commmission decided to issue certificates of public convenience for the construction of spurs from the Texas Midland R.R. Co. and the Kentucky & Tennessee Ry. The former is to extend from Commerce to Greenville, Tex., a distance of 14 miles at a cost of $488,000, and the latter a short spur line from White Oak, Ky., to connect a tract of coal land.

Esch Confirmed to Membership on Commerce Commission

The nomination by President Harding of John J. Esch, of Wisconsin, to membership on the Interstate Commerce Commission was confirmed by the Senate, April 18. Mr. Esch was chairman of the House of Representatives committee on interstate commerce and a joint author of the Transportation Act, otherwise known as the Esch-Cummins bill. He has made an extensive study of the railroad problem

Zoning Powers Given to Three Minnesota Cities

Under an act recently passed by the legislature of Minnesota and approved by the Governor, effective immediately, cities of the state having 50,000 or more (Duluth, Minneapolis and St. Paul), and also any city of the first class operating under a home rule charter adopted pursuant to Section 36, Article 4 of the state constitution, are authorized to make zoning regulations under the exercise of the police power. The governing bodies of such cities, the act states:

> * * * may make different regulations for different districts thereof and may acquire or prepare and adopt a comprehensive city plan for such city or any portion thereof for the future physical development and improvement of the city in accordance with the regulations made as aforesaid and may thereafter alter said regulations or plan, such alterations, however, to be made only after the affirmative vote in favor thereof of two-thirds of the members of the governing body of such city.

In cities having a city planning commission "the act shall be construed as an addition to existing powers and not as an amendment to or repeal thereof, and the governing body may adopt a plan or plans prepared by such city planning commission."

A zoning survey is now under way in St. Paul and it is believed that a zoning ordinance will be ready to be submitted to the City Council this fall. The survey is being made by the St. Paul City Planning Board under the direction of George H. Herrald, city planning engineer. Bennett & Parsons, city planners, have been retained as consultants in the preparation of the St. Paul zoning ordinance.

Thirteenth National Conference on City Planning, May 9-11

The thirteenth National Conference on City Planning will be held at Pittsburgh, Pa., May 9-11, at the William Penn Hotel. Among the papers and discussions on the program are: "The City Plan and Living and Working Conditions," by John Ihlder, Manager Civic Development Department, U. S. Chamber of Commerce, Washington, D. C.

"How Zoning Affects Living Conditions," by Robert H. Whitten, Herbert S. Swan, Lawrence Veiller and George B. Ford; Luncheon topic, "The Place of Zoning in the City Plan," by Edward M. Bassett; "The Zoning Ordinance of Pittsburgh," by J. M. Clark and U. N. Arthur, "River Transportation" and "River Front Improvement and Flood Protection"; "The Enforcement of a Street Plan," by Arthur S. Tuttle, chief engineer, Board of Estimate and Apportionment, New York City, with discussions by Frank B. Williams, Andrew Wright Crawford, B. Antrim Haldeman and Harland Bartholomew; "The Major Street Plan of Pittsburgh," by James D. Hailman; "Some New Suggestions for Street Widening"; The Use of Aërial Photography.

Western Society Protests Sanitary District Appointment

Protest against the appointment of E. H. Moore, former business agent of the Hoisting and Portable Engineers Union, as assistant chief engineer of the Sanitary District of Chicago (noted in *Engineering News-Record*, March 31, p. 572), has been made by the Western Society of Engineers to the board of trustees of the district. The board of direction of the Western Society, approving the recommendation of its public affairs committee, objects to the appointment on the ground that the office "should be filled by a professional engineer, selected on the basis of his qualifications and experience and that he should be a man capable of acting as technical adviser to the chief engineer and able to assume his duties if necessary."

Survey for Deeper Channel Over San Francisco Bay Entrance

The U. S. Coast and Geodetic Survey has completed surveys and soundings of the bar at the entrance to San Francisco Bay and has turned the data over to the U. S. Army engineers. The latter are making a more detailed survey and examination in the preparation of a cost estimate on dredging a deeper channel over the bar.

The channel along the north shore is fully 40 ft. deep at low water, but is somewhat tortuous. Over the center of the bar the depth is now 33 ft. at low water, and it is planned to increase this to 40 ft. to provide ample depth for the largest vessels. The shallow part of the bar is well outside the Golden Gate proper which is only one mile wide and has a depth of about 300 ft.

Philadelphia-Camden Bridge To Have Clearance of 135 Ft.

The War Department has accepted a clearance of 135 ft. over a channel width of 800 ft. for the Philadelphia-Camden bridge now being designed by the Delaware River Bridge Joint Commission and plans are now going ahead on that basis. The Board of engineers made the following progress report on April 15:

> Work on preliminary plans and report on the bridge has so far advanced that we will be ready to place them in your hands early in June.
>
> The contractor on test borings is now engaged in putting down the last test hole in the river on the Camden side south of the Federal St. ferry terminal. This work should be completed with the next few days.
>
> We have completed our analysis of the data on vehicular traffic over the ferries, secured in the three-day traffic count taken last December and from the records of the ferry companies. Studies are now under way of the vehicular traffic at present carried by those streets adjacent to the proposed approaches of the bridge.
>
> The drawings which we will submit accompanying our report will show the location studied, general design of the recommended type of structure and the results of the borings. Traffic and other special studies are well advanced toward completion. The architectural drawings of the principal features of the bridge are now being rendered.

Kern River Reaction Turbine in Service Under 806-Ft. Head

The first of two 22,500-hp. units in the Kern River No. 3 plant of the Southern California Edison Co. was put in service on April 1 and since that date has been delivering 17,000 kw. to the company's transmission system. Special interest attaches to this plant because the head of 806 ft. is said to be the highest thus far used on a reaction turbine. The second unit is expected to be in operation early in May and soon after the plant is handling its capacity load. Official tests are to be made of the larger units.

New Institution of Traffic Science in Cologne

Little attention has hitherto been the given to study of traffic problems in Germany. A few universities had introduced lectures on railroad traffic and shipping, without, however, treating the traffic problem in all its various branches. Various kinds of transportation, such as motor and aerial traffic, have not been touched.

German forwarding agents have now combined in the formation of an Institution for Traffic Science, at the suggestion of Privy Councillor Prof. Dr. Harms, president of the Institution for International Traffic, at Kiel. The seat of the Institution will be Cologne, which, on account of its commercial university, provides excellent accommodation. Another consideration in favor of Cologne was the fact that many prominent German shipping firms have settled down there, thus providing exceptional facilities for the students to round up their theoretical education by acquiring practical experience.

The idea has met with ready approval by the municipality of Cologne, which will probably grant a subsidy of 50,000 marks a year toward the maintenance of the Institution, and by the Cologne Chamber of Commerce and Trade, which has set aside an amount of 25,000 marks per annum for the same purpose. Several other public bodies throughout Germany have promised similar help.

Rail Unions Charge Neglect in Engineering Research

Neglect in engineering research is one of the nine principal causes of waste in the operation of the railroads cited by witnesses of the railroad labor unions before the Railway Labor Board at Chicago, April 20. The following paragraph embodying this specific charge was read into the record:

"Administrative neglect to maintain engineering research, and neglect or resistance to improvement generally. Railroad administrators have been so backward and so addicted to rule-of-thumb methods that they have neglected or refused to establish scientific laboratories and bureaus of research for the improvement of the railway service, as has been done successfully in all progressive industries."

ENGINEERING SOCIETIES

Calendar

Annual Meetings

AMERICAN ASSOCIATION OF ENGINEERS, Chicago; Seventh Convention, Buffalo, N. Y., May 9, 10 and 11.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS, New York; Spring meeting, Chicago, May 23-26.

AMERICAN WATER WORKS ASSOCIATION, New York; Convention, Cleveland, June 6-10.

NATIONAL FIRE PROTECTION ASSOCIATION, 87 Milk St., Boston, Annual meeting, San Francisco, June 14-15-16.

AMERICAN SOCIETY FOR TESTING MATERIALS, Philadelphia; Annual meeting, Asbury Park, N. J., June 20-24.

The Massachusetts Highway Association at its annual meeting at Boston, Feb. 24, elected the following officers: President, Henry V. Macksey, superintendent of public works of Framingham; vice-president, Robert P. Marsh, department of streets, Springfield; secretary, John A. McCarthy, Natick; treasurer, Charles A. Brown, Wellesley; directors, John A. Gaffey and Henry A. Spates.

The Montana Society of Engineers, at its thirty-fourth annual convention, April 9, elected the following officers: President, George T. McGee, Helena; first vice-president, Chauncy L. Berrien, Butte; second vice-president, Leon D. Conkling, Bozeman; secretary and librarian, Earle B. Young, Butte; treasurer, Harry H. Cochrane, Butte. Papers were read by James Kyd who described the construction of pipe lines between Divide and Butte, and by E. L. Larison on the phosphate industry in Anaconda.

The Seattle (Wash.) Section Am. Soc. C. E., on April 4, was addressed by Stuart Mannell on "The Republic, and Why."

The Buffalo (N. Y.) Section, Am. Soc. C. E., at its first annual meeting, April 5, elected the following officers: President, A. L. Johnson; vice-president, G. B. Bassett; secretary-treasurer, B. L. Cushing.

The San Francisco Section, Am. Soc. C. E., made an inspection-excursion April 2-3 of pumping plants and land reclamation projects generally, along the Sacramento River below Colusa which is about 160 miles from San Francisco. The party, totaling 130 members and guests, drove to Colusa in automobiles on Saturday. Sunday morning the automobiles were put aboard a river steamer chartered for the trip down the river. Stops were made at points of interest en route. The drainage plant at District 1500 has six 50-in. pumps connected to six 800-hp. motors. Luncheon was served on the America, a dredge operating a 6-cu.yd. bucket on a 235-ft. boom. The automobiles were unloaded at Knights Landing, whence the return trip was made overland.

PERSONAL NOTES

WILLIAM E. SWIFT, who recently returned from Greece, where he was engaged on an examination for a new water supply for Athens, has opened an office in New York City as consulting engineer. He is a graduate of the Massachusetts Institute of Technology, class of 1895. His professional experience includes service with the Metropolitan Water Board, Boston, Mass., the New York subways, government irrigation in the west, the Panama Canal, and the Catskill aqueduct for New York City's additional water supply. On the latter work he served as division engineer in charge of the Hudson River division and had charge of the big inverted siphon tunnel which crosses under the bed of the river at a depth of about 1,100 ft. In 1911, after leaving the Catskill work, Mr. Swift became associated with the firm of Ford, Bacon & Davis, engineers, New York City, where his duties included the construction of extensive irrigation works in Montana, the building of dams and reports on engineering projects of various types. It was for this firm that he made his investigation of the water supply for Athens. Mr. Swift brings to his consulting work an extensive experience in hydraulic engineering, water supply, tunneling, dams, and irrigation, and will specialize in these lines.

CARL H. PETERSON, formerly city engineer of Cadillac, Mich., has been appointed city manager of Mt. Pleasant, Mich.

J. L. MAHAFFY has been appointed town engineer of Montreal West, Que.

FRANK S. PECK, former state highway engineer, South Dakota, has been appointed highway engineer of Minnehaha County, S. D.

JAMES P. BROWNELL, civil engineer with offices in Carthage, N. Y., has been appointed city engineer of Carthage.

PAUL A. LAZENBY, recently in private engineering practice in New York City, has been appointed engineer to the newly-organized Toronto Transportation Commission, Toronto, Ont. He was graduated from the Massachusetts Institute of Technology in 1904. He then spent four years in general engineering and construction work with the Chicago, Burlington & Quincy, and was also with the Grand Trunk Pacific Ry. in charge of construction. He has served as associate engineer with the Chicago Plan Commission and was also associate engineer in the preparation of city plans for Brooklyn, Minneapolis and Detroit, and for the Federal Plan Commission of Ottawa and Hull. He is now engaged in the preparation of a general plan for the unification of the civic railways of Toronto with the Toronto Railway Co.'s lines.

A. J. TEED has been appointed city engineer of Cadillac, Mich.

ELWIN S. HASTINGS and ALFRED E. WHITE have been appointed acting division engineers of the New Hampshire State Highway Department, with headquarters at Keene.

FRANK BURTON, an engineer with Donaldson & Miers, has been appointed commissioner of the department of Buildings and safety engineer, Detroit, Mich.

B. H. TONG, formerly assistant city engineer, Bismark, N. D., has been appointed superintendent of highways of Emmons County, N. D.

WARREN E. MOORE, civil engineer, of the engineering firm of Moore & McClure, Oklahoma City, has been elected commissioner of public works of Oklahoma City. He was graduated from Purdue University in 1897, and was employed in the city engineering department, Lafayette, Ind. Later he was connected with the Illinois Central R.R. in the maintenance of way department, the Chesapeake & Ohio R.R. and, in 1901, again with the Illinois Central in the bridge and building department.

ELIJAH H. OWEN, superintendent of construction of the H. M. Lane Co., Detroit, Mich., announces his association with Charles Roberts Seabrook, mechanical engineer, for the practice of industrial engineering. The firm of Owen & Seabrook proposes to handle industrial buildings, factory layout and mechanical handling of materials, valuation surveys and work routing.

C. E. RICE, who has for the past year been handling municipal improvements for real estate developing companies in Akron, Ohio, has been appointed city engineer of Wooster, Ohio.

B. C. FREEMAN, formerly with the county road commission of Sanilac County, Mich., has been appointed resident engineer of pavement projects and roads for the state highway department in Sanilac County.

L. C. READ, JR., has been reappointed city engineer of Sandusky, Mich.

W. C. COOPER has been appointed city engineer of Kalispell, Mont.

W. R. TALBOT, recently resident engineer on highway construction, Santo Domingo, is now engineer for the good roads committee of the Chamber of Commerce of Danville, Va.

JOHN L. SNEED has been appointed resident engineer for the Virginia State Highway Commission, with headquarters at Richmond, Va.

NORMAN F. BROWN, assistant to the chief engineer of the Pennsylvania R.R., has been appointed director of public works, City of Pittsburgh, Pa., by Mayor Babcock to succeed John Swan, resigned. He has been connected with the Pennsylvania R.R. for the past ten years. He has had charge of the tunnels recently completed on the Conemaugh division and of the work of shortening the line to Buffalo and has built four bridges over the Allegheny and Monongahela Rivers.

J. R. SEXTON, regional engineer, Erie R.R., with headquarters at Chicago, Ill., has been appointed division engineer at Huntington, Ind.

D. S. FARLEY, recently division engineer of the Atchison, Topeka & Santa Fe Ry., at Dodge City, Kan., has been appointed assistant general manager, western district, with headquarters at Topeka, Kan.

A. A. MILLER, formerly district engineer, Missouri Pacific R.R., with headquarters at Kansas City, Mo., has been appointed superintendent of the Missouri division with headquarters at Poplar Bluff, Mo.

ERNEST S. ALDERMAN, formerly U. S. senior highway engineer at Oklahoma City, Okla., has been appointed state engineer of Oklahoma. He has been with the U. S. Bureau of Public Roads since 1912, with the exception of two years during the World War, which he spent at Camp Travis, Tex., as supervising engineer and assistant utilities officer in charge of construction and maintenance of roads.

SAMUEL J. HUMES, former county engineer, King County, Wash., has organized the firm of Samuel J. Humes & Co., civil and consulting engineers, with offices in Seattle. The firm will specialize in surveys, estimates, municipal improvements, road and bridge construction.

OBITUARY

JOHN H. BLOOMSHIELD, consulting engineer, Bay City, Mich., died March 18. He was born near Lillehammer in the province of Hamar, Norway, in 1856, and was graduated from the Military Academy of Norway at Fredericksbald, civil engineering course, in 1878. Until the latter part of 1880 he was employed as assistant engineer of the Norwegian Topographical Association at Christiania. He came to the United States in 1880 and in 1881 he was employed by the U. S. Government Coast Survey service. In 1882 he entered railroad engineering work, becoming assistant, division, and chief engineer for branch lines ultimately taken in as part of the Grand Trunk, Michigan Central, and Pere Marquette R.R. systems. He served as city engineer of Bay City for several years and also as local drainage commissioner. In 1899 he had charge of the construction of the water-works and electric lighting plant on Saginaw Bay. In 1901 he entered private practice as a consulting engineer, engaging in municipal and general engineering work. He has designed and supervised the construction of municipal improvements for numerous cities and towns in Michigan. For the past 23 years he served as engineer for the Bay City Bridge Commission and for the past 28 years he was highway engineer for the Bay County Road Commission, Mich.

SAMUEL E. TINKHAM, since 1874 connected with the engineering department of the City of Boston, Mass., and with its successor, the Department of Public Works, died April 21. He was graduated from the Massachusetts Institute of Technology in 1873, and began work in the engineering department of Boston in 1874. In 1914 and 1915 he was acting division engineer of the bridge and ferry division of the public-works department at Boston and later became engineer of construction of the division. He was prominently connected with the management of the Boston Society of Civil Engineers for more than 40 years and was its secretary from 1880 to 1882, and again continuously from 1887 to date.

HENRY K. PORTER, president of the H. K. Porter Co., Pittsburgh, locomotive manufacturer, died April 10 in Washington, D. C. He was born in Concord, N. H., in 1841, and was graduated from Brown University with the degree of Master of Arts in 1860. He served in the Union Army during the Civil War. In 1866 he began his business carreer in Pittsburgh with Smith & Porter, specializing in the building of light locomotives. In 1899 he became president of the H. K. Porter Co., for the past 20 years engaged in the manufacture of both heavy and light locomotives.

LESTER G. FRENCH, editor and manager of *Mechanical Engineering*, official journal of the American Society of Mechanical Engineers, of which he was assistant secretary, died April 18 at the French Hospital, New York City. He was born in Keene, N. H., 1869, and was graduated from the Massachusetts Institute of Technology in 1891. He began his career as a draftsman and later served with the International Correspondence Schools at Scranton, Pa., as instructor in mechanical engineering. In 1897 he became editor-in-chief of *Machinery*, resigning in 1906 to publish technical books. He wrote one of the earliest treatises on the steam turbine. In 1908 he was made editor of the journal of the American Society of Mechanical Engineers, of which society he was elected a junior in 1899 and a member in 1912.

H. A. CLAPP, president of Clapp, Norstrom & Riley, Chicago, handling railway and construction equipment, died April 11 in California. He was 68 years of age.

BUSINESS NOTES

C. S. KNOBLAUCH has been appointed general manager of the Machais Sand & Gravel Co., Machais, N. Y.

WILLIAM S. TURNER & CO., Portland, Ore., has been organized as manufacturers' agents for the sale of equipment for electric railways, lighting and power systems, pumping and industrial plants; to make investigations, reports and appraisals; and to design and construct public utility, municipal and manufacturing works.

THE PITTSBURGH DES MOINES STEEL CO., Pittsburgh, Pa., has opened an office in Detroit to handle the Michigan and northwestern Ohio territory. M. P. Cogswell will be in charge of the office.

THE CONVEYORS CORP. OF AMERICA, Chicago and New York, announces the appointment of Robert B. M. Wilson as sales engineer for the Chicago district.

WILLIAM H. NORDEN, formerly New York district manager of the Carbic Manufacturing Co., is now secretary and treasurer of the Dewey Supply Corp., New York, formerly known as the Parsons Engineering & Machinery Corp. This company handles a line of contractors' and municipal equipment and supplies.

VICTOR T. GOGGIN, recently New England sales manager of Fred T. Ley & Co., Inc., of Springfield, Boston and New York, has resigned to become associated with Dwight P. Robinson & Co., Inc., as contracting engineer.

W. R. NOXON, formerly sales manager for the Davis-Bournonville Co., New York, and, later, district manager at Chicago, has been appointed sales manager for the Alexander Milburn Co., Baltimore, Md.

H. M. DAVIDSON, who was from 1903 to 1919 with the Hayward Co., New York, manufacturers of orange-peel and clam-shell buckets, and for the past two years general sales manager for the Ohio Locomotive Crane Co., Bucyrus, Ohio, has again become associated with the Hayward Co. and will hereafter be connected with the management of the company. Among other duties he will have the general management of sales.

THE HALLIDIE MACHINERY CO., Seattle, Wash, has been appointed representative of the Conveyors Corporation of America, Chicago, to handle the sale of the American steam conveyor and American trolley carrier in Washington and Oregon.

J. E. TRACY, for the past four years general sales manager of the Sterling Motor Truck Co. of Milwaukee, Wis., became actively connected on April 1 with the Hicks-Parrett Tractor Co. of

Business Side of Construction

Facts and Events that Affect Cost and Volume

Weekly Car Report

An improvement in the demand for cars during the week which ended on April 15 is shown by reports just received from the railroads of the United States by the car service division of the American Railway Association. The number of surplus or idle freight cars on American railroads for the week was 499,479, or a decrease of 7,948, compared with that for the previous week, when a new high record in the number of idle cars was shown.

This reduction in the number of cars for which there is no freight was due entirely to an increase in the demand for coal cars, the number of surplus coal cars being 252,010, or a decrease of 9,284, compared with the previous week. Reports showed, however, that the number of idle box cars remained virtually unchanged, there being 176,805 on April 15, compared with 176,916 on April 8.

Compared by districts, decreases in the number of surplus cars were shown in the Allegheny, Pocahontas, southern, central western and southwestern regions, while increases were reported only in the eastern and northwestern.

Factors Delaying Readjustment

Recovery is delayed by several unsettling factors. These include, in about the order of their importance: (1) The uncompleted liquidation of labor. (2) The unexpectedly poor showing being made by the railroads under the Esch-Cummins law, and apprehension over impending labor developments. (3) Tardiness in reducing prices by numbers of basic industries. (4) Unforeseen delay in starting machinery to extend credits to foreign purchasers. (5) Retention of high money rates for a period almost without parallel in our financial annals. (6) The failure of the retail trade, as a whole, to lower prices commensurate with the drastic declines in wholesale prices. (7) Acute dissatisfaction in responsible circles over tax burdens and the absence of any definite plan in Washington to effect thoroughgoing reform and economy. (8) Tariff uncertainties. (9) Germany's refusal to meet the Allies' demands and the new outbursts of rebellious lawlessness by 'Reds." Nevertheless, things are slowly getting better, not worse.—*Forbes Magazine.*

A. G. C. Executive Board to Meet

The executive board of the Associated General Contractors will meet in Washington May 9 and 10 to outline the year's work and to discuss the legislative activities which will be undertaken.

British Emergency Act Gives Government Broad Powers

(London Correspondence)

Regulations recently made by an order in council under the emergency powers act enables the British government:

1. To take possession of land, buildings, or works, including those of public utility undertakings.
2. To take possession of food, forage, material and stores.
3. To regulate and control road transport, and to take possession of or hire compulsorily, horses and vehicles.
4. To take over tramways and light railways in whole or in part.
5. To control traffic on highways.
6. To grant motor driving licenses.
7. To control canals and canal traffic.
8. To close ports or harbors.
9. To regulate and restrict traffic by sea.
10. To prohibit the export of any goods.
11. To take possession of coal mines, machinery, plant, wagons and stocks of coal and to regulate coal supplies and fix prices.
12. To control gas, water and electricity undertakings.
13. To regulate or prohibit the sale, delivery or use of motor spirit.
14. To restrict the use of the telegraphs.
15. To prohibit dealing in or the carrying of firearms or ammunition.
16. To prohibit public meetings and processions.

Failure to comply with the regulations under these heads, or any attempt to interfere, or to induce others to interfere, with their due fulfillment or enforcement, will constitute an offence for which the maximum penalty will be three months hard labor and a fine of £100.

These regulations have been conferred upon the government by urgency councils, and steps to bring them into force may be taken if, and when, the government deems it necessary.

Road Contracts For 90 Miles Let

Since April 1 the Pennsylvania Highway Department has let highway contracts aggregating $6,000,000 in value. This involves the construction of about 90 miles of roads, including excavation, grading and surfacing, mostly with reinforced concrete and Hillside brick. The month's total was increased by the letting, during the past week, of three contracts aggregating $680,387 in value.

Cement, Lumber and Steel Before and Since the War

Prices over 9 to 12 Years—Cement the Flattest Curve—Steel Nearest Prewar Level

To show what has happened in the last decade in the basic construction industries, curves are here presented of the base prices of structural steel at Pittsburgh, Southern pine in New York, and cement in Chicago. The characteristics of the three industries during the war period are clearly depicted. The war peak in steel occurred in July, 1917. Government regulation set the curve at $3 per 100 lb. in October, 1917. Since October, 1920, the price has been falling, the present quotation being $2.20 for steel shapes.

The New York lumber market was remarkably steady during the eight years prior to 1917, when the upward war movement began. The average price in 1909 was $25.50 and $31.50 in 1916, with an average of $28 over the eight-year period. The following are the yearly averages to date:

1917	$37.75
1918	$43.25
1919	$50.00
1920	$67.50
1921 (five months)	$54.00
Today	$48.00

The bottom price, August, 1909, was

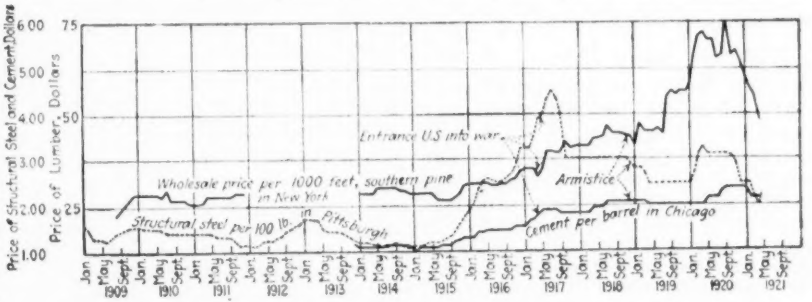


FIG. 1—CEMENT, STEEL AND LUMBER PRICES OVER 12-YEAR PERIOD

$22.50, the peak $75 in September, 1920. Since the peak, prices have slumped so sharply that the market today is far from being stable.

From January, 1913, to date there were twenty-five changes in cement prices, of which twenty were advances. The increase over 1913 is 82 per cent.

The cement curve is the flatest of the three. The tremendous upward movement of general prices from 1915 to 1917, inclusive, carried cement with it. The rise, however, was gentle compared with that of steel and lumber, although it has been more persistent.

A better understanding of the agreement between the price trends of steel and cement since 1900 may be had by examining the curves on p. 487 of

Engineering News-Record of Mar. 17. These curves are of prices of structural steel shapes in Pittsburgh and of the average factory prices of cement over the entire country. In the case of both these products, the general movement had been downward from 1910 to 1914, at which time steel started on its rapid journey to the peak of 1917. The rise in cement did not begin until 1915, but it continued long after 1917.

Fig. 2 is a comparison of price trend with production since 1908. Whether production rose or fell the average price of cement increased steadily from

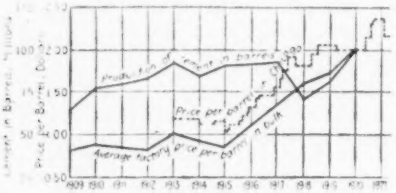


FIG. 2—PRICES AND PRODUCTION OF CEMENT COMPARED

1915 to 1921, owing to advances in the cost of materials and labor. At present, the average factory price is about $2, as against $1 in 1913. On the other hand, the present Chicago price of $2.17 is only 82.4 per cent over the 1913 figures. Structural steel is 47 per cent above 1913; lumber, 68 per cent, while labor, which enters into the costs of all these materials, averages for the seventeen cities covered by *Engineering News-Record's* quotations $4.50 per day now, or 150 per cent above the average rate of 1913, which was $1.80.

Asphalt Association Holds Second Annual Convention

At its second anual convention held in New York April 13 the Asphalt Association adopted resolutions as follows:

Urging Congress to pass the federal-aid appropriation of $100,000,000; urging that highway management be diverced from politics and materials and methods be placed in open competition; declaring that every highway be required to show traffic justification for its construction; memorializing Congress to authorize the United States to join the Permanent International Association of Road Congresses; urging the Interstate Commerce Commission to authorize a reduction in freight rates for road materials; recommending that public officials carry forward road-building programs to the extent permitted by appropriations available, thus giving employment to many hundred thousand men now out of work and utilizing tens of thousands of idle open top freight cars.

The directors elected F. P. Allen of the Standard Oil Co. of Indiana, Chicago, Ill., as vice-president to succeed J. M. Woodruff of the Sinclair Refining Co., Chicago, and re-elected J. E. Pennybacker, secretary.

Indiana Contractor Loses in Suit Over Road-Construction Bond

The Indiana appellate court has just ruled against the Foulkes Contracting Co., Terre Haute, Ind., in a suit regarding a surety bond. The contracting company made an application to the United States Fidelity and Guaranty Company some months ago for a road-construction bond in which it promised to pay $5 for the bond and if the bid was accepted $413.50 additional as the first year's premium, and $418.50 annually thereafter until it furnished evidence of the completion of the work and discharge from future liability.

The insurance company filed suit in the lower courts for two annual premiums. The contracting company filed an answer to the effect that at the time of application, it was agreed between it and the agent of the insurance company that if the contract was awarded the contracting company it should have the right to secure a personal bond for the construction and the $5 should in that event cover the whole obligation.

The trial court found for the insurance company and the appellate court held that any alleged oral agreement between the two prior to the writing of the application for the bond sued on, could not operate as against the terms written in the application, that the statutes do not contemplate the giving of a bond different than that tendered with the bid and that the appellee had a continuing liability on the bond, though the board of county commissioners permitted the contracting company to substitute a personal bond in the place of that tendered with the bid.

Building Contractor's Employees Agree to Increase Output

(*London Correspondence*)

At a mass meeting of 500 men, the emloyees of Messrs. W. G. Tarrant, London building contractors, recently agreed to increase their ouput by 10 per cent in order that their employers may reduce their building estimates by at least 7½ per cent. This firm holds large Government contracts and employs several thousand men all over the country. W. G. Tarrant, the managing director, says that in the interests of the building trades wages must not increase at all during the next three months. Further, most of the money borrowed by the Government for housing schemes had been already used; evidence of this being supplied by the curtailing of the building schemes now in force, and, in Mr. Tarrant's opinion, these schemes might shortly be closed down altogether, thus precipitating another crisis in the building industry unless costs were considerably reduced. Moreover, private builders could not be expected to build cottages at what they had been costing the Government, about £1,400, and he thinks £600 will be the irreducible minimum next year.

Northwestern Lumber Production 61 Per Cent of Normal

According to a recent bulletin issued by the West Coast Lumbermen's Association, lumber production in western Oregon and western Washington for the week ended April 9 was 39 per cent below normal. The actual production at the 119 representative mills was 52,330,268 ft. b.m., new business 57,306,837 ft. b.m. and shipments 62,674,712 ft. b.m. Local business is active, reads the report, with new work totaling 2,603,585 ft. b.m. and deliveries being 4,530,088 ft. b.m.

Wage Conditions in Britain

(*London Correspondence*)

It is generally felt that all wages in the engineering trade will fall in June, until which time wages have been stabilized by an agreement arrived at by the empoyers and employees. Orders to engineering firms in this country have fallen off considerably and practically no engineering contracts with Europe are being received. In some cases engineering firms have sacrificed their profits to keep their plants working. Many firms have cut their prices quoted by as much as 20 per cent, but this has proved fruitless.

The impending wage reductions have galvanized the trade unions into activity and efforts are being made to formulate a common policy of resistance to any reductions contemplated by the employers.

The Engineering and National Employers' Federations have issued a statement which deals with the present trade situation. The statement finds the present low state of the engineering trades due chiefly to:

1. Complications of the foreign exchanges.
2. Depreciation of European exchanges due to currency inflation and inability to export on account of low production; i.e., underproduction in Europe means apparent over-production in Britain.
3. Low individual output in Britain leading to prices at which Europe will not or cannot buy.
4. German mark has two values at present, internal and external, the first being two-and-a-half times as great as the latter, which means that the German workman receives a wage which for foreign competition, is only two-fifths of its internal value.
5. The home "consumers' strike."

It is interesting to note that wage standards at the end of last December, compared with pre-war figures, were:

	Per Cent
Railways, some lower grades	270
Railways, foremen, some grades	140
Building trades, hourly rates	225
Building trades, weekly earnings	190
Coal mining	160
Engineering	145
Shipbuilding	144

Road Machinery Exports

Road-making machinery valued at $107,865 was exported during March, 1921, according to the figures compiled by the Bureau of Foreign and Domestic Commerce. This is a slight decrease from March of last year, when the value was $120,331.

Wage Situation in the Building Industry

The wage situation continues acute in the building industry. New cuts have been announced by builders in various cities and in general they are being opposed. The rejection by 70 per cent of the unions in Chicago of the proposed decrease has led the employers to issue a statement that they would stand pat on their proposal to reduce in general from $1.25 an hour to $1 for skilled mechanics and from $1 to 70c. for laborers. Unions are to be given until May 1 to accept that scale; failure to accept which, it is said, may result in a lock-out involving the 60,000 building trade employees in the city of Chicago, and postponing indefinitely approximately $100,000,000 worth of work.

Cleveland has recently announced a cut in the wages of carpenters from $1.25 to 90c. Unions in Portland, Ore., are ballotting on whether they will accept a 10 per cent reduction. The painters of New Britain, Conn., have accepted a 15 per cent reduction, whereas in New Haven, Hartford and Waterbury, other Connecticut towns, general wage reductions in the neighborhood of 20 per cent have been opposed, the proposal of a reduction having been answered in Waterbury by a strike. A general strike has been precipitated in Indianapolis through the proposed reduction of 20 per cent in building-trade labor and it is estimated that around 5,000 men are involved. Though building trade employers of Rockford, Ill., proposed a 20 per cent reduction, which was opposed by all unions, the masons voluntarily made a reduction of 10 per cent.

The Building Trade Employers Association of Boston opened an employment office recently, more than 400 men applying for employment during the first few hours it was opened. Boston builders still continue operations on an open-shop basis.

Commission Government at Buffalo Survives Mysterious Attack

What is described as a bill of mysterious origin, designed to cause the abandonment of the commission government plan at Buffalo, N. Y., was passed by the last legislature, but vetoed by the Mayor of Buffalo and not passed over the veto before the legislature adjourned. Known as the Gibbs-Rowe bill, the proposed act provided for a council of 15 members, six to be elected at large and nine from nine "council zones," and for a Mayor with large powers. The proposal to abandon the commission plan was strongly opposed at a public hearing. At this hearing the sponsors of the bill declined to state who had drafted the measure. Another bill aimed at the commission plan in Buffalo, known as the Swift-Brady bill and described as another variant of the mayor-and-council plan, did not make much progress.

Large Pittsburgh Building Moved

The widening of Second Avenue in Pittsburgh, made necessary the moving of an eight-story building a distance of 40 ft. The building was a brick and steel structure about 30 x 120 ft. and was loaded with hardware. It was necessary to move it without any disturbance to business. The usual business proceeded during the entire operation, which was carried out last week.

The weight of the structure was more than 5,000 tons and it was necessary to use 880 screw jacks to lift it. It was lifted 16 in. together with the sidewalks at the front and side and slid over by means of ten screw jacks moving at the rate of 1 ft. an hour on steel rollers operating on rails. This work was let to the John Eichelay, Jr., Co. of Pittsburgh, and was done at a saving to the city of over $100,000.

Bricklayers' Output in Britain

(London Correspondence)

Some discussion has arisen in England over the fact that bricklayers employed by the building guilds on contracts under the Ministry of Health are laying 900 bricks per day, while those employed by private contractors are not laying more than 300. The Minister of Health states that if the output could be raised from 300 to 900, two months would be saved on the construction of each house, and the money saving effected would be about £70 per dwelling.

Device for Thawing Fire Hydrants

A portable device for thawing fire hydrants by steam from a steam coil heated by acetylene was demonstrated recently in New York City. The device consists of a steam coil surrounded by a water jacket and a ten-jet acetylene burner beneath the coil. The burner is supplied with dissolved acetylene such as the Prest-O-Lite Co. compresses into cylinders for auto truck and tractor lighting. Water is forced from the water jacket into the steam coil by a hand pump. The superheated steam thus produced is played through a hose upon the frozen hydrant. The device was invented by Louis F. Ross and is made by The American La France Fire Engine Co.

Past Week Second Heaviest of Year in Building

Exceeded by the previous week by the small margin of 1½ per cent, the contracts let during the past week, as reported in *Engineering News-Record*, give the second highest total figure for the year—$30,482,334. Last week's contracts totaled $30,874,237.

This week's total is large mainly because of the increase in the construction of miscellaneous buildings—educational, bank and office, theater, church, etc.—the total for this class being the largest figure of any week this year, $15,550,258, more than 50 per cent of the total. Street and road contracts, though many in number, totaled but approximately $7,000,000. The largest buildings for which contracts were let include a $2,000,000 theater and office building in Detroit, a $1,000,000 church in Lackawanna, N. Y., and a $1,000,000 hotel in New York City. The largest street and road contracts were let by Pennsylvania, Wisconsin and Oregon, these three states letting contracts aggregating $2,114,616.

A marked increase is noticed in the number and value of sewer, waterworks and bridge contracts let during the past week, the total value of this class of work being $3,857,523. Industrial building also shows an increase, a number of small manufacturing plants being contracted for in New England and elsewhere.

Municipal Paving Contract Is 83 Per Cent of Estimate

In a recent letting of municipal paving contracts in Gary, Ind., it was found the total bid of the successful bidder was only 83 per cent of the engineer's estimate. Sheet asphalt of a 1-in. binder and a 1½-in. top was estimated to cost $2 per square, whereas the low bid was $1.67. The accompanying table indicates where the saving of $2,698 on $13,662 worth of work was effected.

ESTIMATE AND SUCCESSFUL BID ON GARY, IND., STREET JOB

	Sheet Asphalt 1-Inch Binder 1½-Inch Top Per Sq. Yd.	Regrading per Sq. Yd.	Concrete Header, Lin. Ft.	Reset Catch Basin Covers,	Curb and Gutter Rebuilt Lin. Ft.	New Material in Place (Holes), per Ton	Extra Binder per Ton	
Engineer's estimate	$2 00	$0 20	$1.50	$5 00	$2 00	$5 00	$10 00	$16,360
Low bid	1 67	10	1.50	3 50	1 90	4 00	9 00	13,662
Unit difference	33	10	.....	1 50	10	1 00	1 00	.....
Quantities	5,065 2	5,065.2	188	7	300	100	380	.....
Total difference	$1,671.52	$506.52	.....	$10 50	$30	$100	$380	$2,698

Oregon Highway Bids 80 Per Cent of Estimates

On April 23 the Oregon State Highway Commission let contracts for the construction of approximately 73 miles of highway, the total estimate of the engineer on which was $928,286, and

the total contract price $831,172, a difference of $97,114. The successful bid in each case was considerably under the engineer's estimate, there being ten projects involved. Most of the work is only grading, shaping, and in some instances, surfacing. One large paving contract was let, the estimate on it being $415,841 and the contract price, $383,583, or about 8 per cent below the estimate, involving the construction of 12½ miles.

Million-Foot Southern Pine Order Closed

The Marsh & Truman Lumber Co., Chicago, last week sold a million-foot order of Southern pine to the Lackawanna Bridge Co. for that concern's Tonawanda, N. Y., project. It is understood the order consisted mainly of dressed long-leaf timbers from 12 in. to 4 in. and 4 x 6-in. and 3 x 8-in. short-leaf material.

Spokane Forms A. G. C. Branch

Contractors of Spokane have formed a local branch of the Pacific Northwest Chapter of the Associated General Contractors of America. Offices of the branch have been opened and an executive secretary has been engaged, says a recent copy of the A. G. C. *Bulletin*. The new association starts with a membership of more than 40 contractors operating in and near to Spokane.

Weekly Construction Market

THIS limited price list is published weekly for the purpose of giving current prices on the principal construction materials, and of noting important price changes on the less important materials. Moreover, only the chief cities are quoted.

The first issue of each month carries complete quotations for all construction materials and for the important cities. The last complete list will be found in the issue of April 7, the next on May 5.

	New York	Atlanta	Dallas	Chicago	Minneapolis	Denver	San Francisco	Seattle	Montreal
Steel Products:									
Structural shapes, 100 lb	$3.33	$4.00	$3.75	$3.23	$3.51	$4.65	$4.45	$5.00	$5.00
Structural rivets, 100 lb	4.85	5.25	7.05	4.88	5.30	6.90	7.05	6.25	8.50
Reinforcing bars, ¾ in. and larger, 100 lb	3.23	3.25	3.85	3.13	3.53½	4.32½	2.35	4.50	4.25
Steel pipe, black, 3½ to 6 in. lap, discount	49%	50.65–5%	45%	58½%	51.9–5%	40%	49.80	40%	5%
Cast-iron pipe, 6 in. and over, ton	63.30	59.22	66.20	64.10	67.80	70.00	85.90	73.00	80.00
Concreting Material:									
Cement without bags, bbl	2.90 (del.)	3.00	2.85	2.17	2.41	3.10	3.09	3.10	3.44
Gravel, ¾ in., cu.yd	2.50	2.80	1.75	2.75	2.00	2.50	2.50	1.50	1.50
Sand, cu.yd	1.25	1.50	1.75	2.75	1.00	1.10	1.65	1.50	1.50
Crushed stone, ¾ in., cu.yd	2.15	2.50	3.20	2.75	2.25	3.50	2.50	3.50	2.10
Miscellaneous:									
Pine, 3x12 to 12x12, 20 ft. and under, M.ft	48.00	38.00	45.00	55.00	38.00	47.00	27.00	48.00	120.00
Lime, finished, hydrated, ton	21.00	18.00	25.00	20.00	29.00	32.00	25.40	24.00	30.00
Lime common, lump, 200 lb. bbl	3.30	1.60	2.50	1.65	2.00	3.20	2.25	2.75	15.00
Common brick, delivered, 1,000	18.40	12.00	25.00	12.00	18.00	14.00	18.00	19.00	18.00
Hollow building tile, 4x12x12, block	Not used	.14	.21	.12	.06	.09	.12½	.13	.19
Hollow partition tile 4x12x12, block	....	.15	.19½	.096	.104	.10	.14½	.11	.....
Linseed oil, raw, 5 bbl. lots, gal	.65	.67	.88	.71	.78	.85	.83	.79	.95
Common labor, union, hour	.75@.80	.35	.60@1.00	1.00	.50	.50@.63½	.81½	.75	.....
Common labor, non union, hour	.....	.25	.40@.60	.50	.50	.37½@.50	.50@.55	.40@.45	.30@.40

Explanation of Prices—Prices are to contractors in carload lots unless other quantities are specified. For steel pipe, the prevailing discount from list price is given; 45-5% means a discount of 45 *and* 5 per cent, 45@50 means a range of 45 *to* 50 per cent. **New York** quotations are delivered except tiles, which are "on trucks." Sand, gravel and crushed stone are quoted alongside dock. **Chicago** quotes hydrated lime in 50-lb. paper bags. **Minneapolis** quotes on fir instead of pine. Brick is $18 delivered, $6 on cars. Gravel, sand and crushed stone quoted at pit. Common labor not organized. **Denver** quotes cement "on tracks"; gravel and sand at pit, stone on cars, lime, brick and lumber on job. Tile price is at warehouse. Linseed oil, delivered. **Atlanta** quotes sand, stone and gravel per ton instead of per cu. yd. **Dallas** quotes lime by the 180-lb. bbl. **San Francisco** quotes on Heath tile, 5½ x 8 x 11½. Prices are all f.o.b. warehouses except C. I. pipe, which is mill price plus freight to railway depot at any terminal. Lumber prices are delivered "at ship tackle in San Francisco ex mill." **Seattle** quotes on Douglas fir, instead of pine; and on lime in paper bags. **Montreal** quotes sand, stone and gravel per ton, and lump lime by the ton. No organized common labor in Montreal.

Changes Since Last Week

It is possible this week to give material prices and labor rates in Birmingham, Ala., and such information will hereafter be included in the *Engineering News-Record's* Monthly Prices of Construction Materials and Labor. Standard open-hearth rails in lots of 500 tons and over can be purchased at $47.50 per gross ton, 12- to 45-lb. rails, at $2.20 per 100 lb. Cast-iron pipe costs $60 per ton. For building materials, the prices are: $14 for common brick, f.o.b. kiln, with $2.75 per 1,000 for delivery charges; 55c. per ton for sand, at pit, $1.43 in the city; $26 to $28 for dimension and form lumber on the site. Cement sells for $3.05 net, on sidetracks or in warehouse. Open-shop labor is paid as follows: Bricklayers, 85c. to $1 per hour; carpenters, 70 to 75c.; hod-carriers, 25 to 40c.; common labor, 20 to 25c.

Cement in New York appears to have reached the bottom. The market is competitive, with $2.90 net the most reliable price to contractors. This quotation allows the dealers a profit of only 4c. per bbl. The wholesale price alongside dock to dealers is $2.40; the unloading charge is 6c.; handling in yard, 10c.; cartage 30c.; profit, 4c.; resulting in a delivered price of $2.90, as stated.

Steel and cast-iron pipe are down in San Francisco, as is also linseed oil. The oil has dropped 1c. in Atlanta and 8c. in Denver. Steel prices have been adjusted in Atlanta warehouses.

Chicago labor unions have declined to accept the 20 per cent cut. Employers have agreed to stop all work on May 1 unless the new scale is accepted. The matter still awaits final decision.

Although the New Orleans metal workers have not returned to work it is probable that a vote to end the strike will be taken next week. This would allow the men to return to work under protest, the differences to be arbitrated. The workers have signified willingness to accept a reduced wage—85c. for mechanics, 50c. for helpers, with a 48-hour week. The real contention is over the open shop.

The Ottawa branch of the Canadian Building and Construction industries has announced a cut of 10c. per hour in most of the trades, making the rates 90c. for bricklayers, 75c. for carpenters, 50c. for common laborers.